DRUGS AND SOLUTIONS
FOR NURSES

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DRUGS AND SOLUTIONS FOR NURSES

BY

STELLA GOOSTRAY, B.S., R.N.
EDUCATIONAL DIRECTOR, SCHOOL OF NURSING,
PHILADELPHIA GENERAL HOSPITAL,
PHILADELPHIA, PA.

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TO

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FROM WHOM CAME THE FIRST INSPIRATION

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FOREWORD

One of the subjects in the Curriculum of the Training School which seems to give difficulty to students is Drugs and Solutions. This difficulty is traceable to a number of causes, among which are the presentation of too many complicated rules and methods and the omission of the basic arithmetic.

The objects of this handbook may be set forth as follows:

1. To provide a text-book for the course in Drugs and Solutions as suggested in the Standard Curriculum for the Preliminary Course.

2. To provide a handbook for the student nurse or the graduate nurse which may be conveniently carried and yet meet her needs.

With these two objects in mind the aims have been:

1. To familiarize those who use it with the weights and measures in common use.

2. To give the abbreviations and symbols used by physicians in ordering drugs.

3. To review the arithmetic necessary for an intelligent understanding of the mathematics of solutions.

4. To give the method of preparing solutions from pure drug or stock solutions.

5. To teach the measurement of fractional dosage.

6. To familiarize the student with the solutions she may be called upon to prepare and use.

7. To serve as an introduction to the further study of Materia Medica.

8. To give a ready reference for the more common drugs used internally.

The summary of drugs is given only for ready reference. For the study of Materia Medica a more complete outline of each drug is necessary such as is found in text-books on Materia Medica for Nurses. Much of the content is in outline form, giving the essential material for the student which may be supplemented by the Instructor.

FOREWORD TO THE SECOND EDITION

In preparing the second edition of this little book the author has kept in mind the increasing use of the metric system in our hospitals. Its advantages are self-evident. Some change has also been made in the classification of the drugs used as disinfectants and antiseptics and new material added. My thanks are due to my co-workers in the teaching department of the School of Nursing, Philadelphia General Hospital, for helpful suggestions.

March 1, 1927.

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DRUGS AND SOLUTIONS FOR NURSES

DRUGS AND SOLUTIONS FOR NURSES

CHAPTER I

INTRODUCTION

APOTHECARIES' WEIGHTS AND MEASURES

Definitions. Materia Medica is the study of substances used in treating the sick. It deals with the sources, physical characteristics, composition, preparation, dosage and effect of such substances, to which we commonly give the name "drug" or "medicine." A Drug is a substance, either an element, compound or mixture, which is used for the cure or relief of disease (away from ease).

The science of Materia Medica has three divisions: (*a*) Pharmacognosy or the technical study of drugs, including their gross and microscopic appearance; (*b*) Pharmacology or the study of the effect of drugs upon the living organism; (*c*) Therapeutics or the art and practice of administering drugs, or other remedial agencies.

Importance to nurse. A nurse never prescribes medicine but she administers it on the prescription of the physician. Her duties in giving medicine are to measure accurately, to give punctually, to have fresh drugs, to observe the effects and to give an accurate report to the physician. To accomplish this she must have definite knowledge, be trained in keen observation and in ethical principles. Accuracy, punctuality and concentration are three watchwords when giving medicines.

Weights and measures. There are four systems of weighing and measuring in common use: (*a*) Avoirdupois Weight, which is used in weighing all articles except gold, silver and precious stones and drugs (except when the latter are bought and sold in quantities); (*b*) Troy Weight, used in weighing gold, silver and precious stones; (*c*) Apothecaries' Weight, which is used by physicians in prescribing and by pharmacists in mixing and compounding medicines; (*d*) Metric Weight, which is now being used very generally in the sciences and in the arts.

There are also measures of capacity, both Dry Measures and Liquid Measures, Apothecaries' Fluid Measure and Metric Measures of Capacity.

A working knowledge of the Apothecaries' and Metric Systems is essential to the Nurse.

Apothecaries' system of weights. The denominations, that is, the series of related units (one) or values, are grains (gr.), scruples (℈), drams (ʒ), ounces (℥) and pounds (lb.).

In order to have a short way of writing, abbreviations or symbols are used, as are indicated in the parentheses. These symbols are very much like those used early in the Christian era, when signs were in common use to express quantities.

apothe

20 Grains (gr.)	1 Scruple	
3 Scruples (℈)	1 Dram	(60 grains)
8 Drams (ʒ)	1 Ounce	(480 grains)
12 Ounces (℥)	1 Pound (lb.)	(5,760 grains)

Fluid Measure. The denominations are minims (♏), fluid drams (fl ʒ), fluid ounces (fl ℥).

60 minims (♏)	1 fluid dram	
8 fluid drams (fl ʒ)	1 fluid ounce	(480 minims)
16 fluid ounces (fl ℥)	1 pint (O)	(7,680 minims—128 fluid drams)

The term "scruple" is seldom used; if less than a dram is used the quantity is expressed in grains. One-half (½) is represented by *ss*.

Methods of Expressing Numbers: There are three methods of expressing numbers:

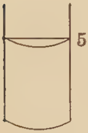
1. By words, as "five," "ten," etc.
2. By letters, called the Roman method.
3. By figures, called the Arabic method.

With the Apothecaries' System the Roman notation is used. Numbers are expressed by means of the seven capital letters, I, V, X, L, C, D, M.

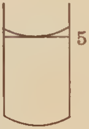
I denotes one.
V denotes five.
X denotes ten.
L denotes fifty.
C denotes one hundred.
D denotes five hundred.
M denotes one thousand.

The physician often uses an old form of these letters, for instance, gr. j. The quantity is used after the symbol.

Measuring liquids. In measuring liquids the medicine glass or minim glass should be held with the thumb-nail placed on the mark which indicates the quantity required, and the mark held on a level with the eye. When liquid is in a container there is a capillary attraction between the solid and the liquid, and the surface of the liquid assumes the form of a concave hemispherical segment, called the concave meniscus. The bottom of the meniscus should be on the same level as the mark indicating the required amount.



Inaccurate



Accurate

Minims and drops are not identical. Always measure minims when minims are ordered and drops when drops are ordered.

To measure minims. Minim glasses are marked off in intervals of five. It is sometimes necessary to measure 3 minims or 8 minims and to be absolutely accurate one cannot do this by guessing where 3 minims would come in the minim glass.

To measure 1 to 4 or 6 to 9 minims—pour five minims or the multiple of five above the required number, that is, for 3 minims pour 5, for 6 minims pour 10. Add enough water to dilute it five times.

Multiply the required number also by five and this will give the number of minims of the dilution which is to be given.

$$3 \times 5 \quad 15$$
$$5 \times 5 \quad 25$$

Example: For 3 minims, pour 5, add water to 25. We now have 25 minims of solution in each 5 minims of which there is 1 minim of drug. To get the required three minims of drug it is necessary to give three fives or 15 minims of the solution, since 3 bears the same relation to 15 as five bears to 25.

To measure a fraction of a minim—for ½ minim dilute 10 times; that is, pour 5, dilute to 50 and give 5 minims of the solution; for ⅓ minim dilute 15 times. Pour 5, dilute 15 times, that is to 75, and give 5 minims of the solution.

Household measures. It is sometimes necessary in the household to use measures which will approximate apothecaries' weights and measures. They are not accurate and should only be used when absolutely necessary.

60 drops...1 teaspoonful	1 dram
2 tablespoonsful	1 fluid ounce
6 fluid ounces	1 teacupful
8 fluid ounces	1 glassful

Drops, teaspoons, tablespoons and cups vary so much in size that this system should never be used if it can be avoided. If it is necessary to give a fraction of a dram in household measure, dilute it with water and give the necessary proportion.

Example: Give gr. XXX. Dissolve one teaspoonful of the drug in another teaspoon of water and give one teaspoon of the solution. For gr. XV, dissolve 1 teaspoonful of the drug in three teaspoonsful of water and give one teaspoonful of the solution.

DRILL:

2880 180

1. Reduce to minims ℥VI, ʒIII.

2. What part of an ounce is gr. XL? 1/12 What part of a dram is gr. XV? 1/3

3. Change the following to drams ℥III. 1440

4. Read the following: ♏XL, ℥VI, fl. ʒI, fl. ℥IX, gr. XIV.

3360

5. How many grains in the following ℥VII, ʒIIIss. 210

6. How would you measure ℥IV with household utensils? 4 tablespoons.

7. How would you give gr. X if you only had household utensils with which to measure?

8. Convert 8,320 grains to drams and ounces.

17 oz. 2 dr. 40 minims

CHAPTER II

THE METRIC SYSTEM

The metric system is a system of weights and measures based on the decimal scale. The system, first adopted in France, is now in use in nearly all the countries of Europe. It is convenient and accurate for fine measurements, is used in all scientific work and is rapidly replacing the apothecaries' system in medicine.

Review of decimals. Since the metric system is based on the decimal system, a clearer understanding of it may be had by a review of decimals.

The successive figures which express a number denote the Orders of Units, numbered from the right, as—

1	1	1	1
Thousands	Hundreds	Tens	Units.

Ten units of any order equal one unit of the next higher order, for example—1, 10, 100.

There are also fractions of units resulting from the division of a unit into tens, a tenth into hundredths, a hundredth into thousandths, as—

1	1	1	1		1	1	1
Thousands	Hundreds	Tens	Units	.	Tenths	Hundredths	Thousandths

Increase in Value *Decrease in Value*

The removal of a decimal point one place to the right multiplies its value by 10.

The removal of a decimal point one place to the left divides its value by 10.

This is the system on which United States money is based—dollars, dimes, cents and mills, mills only being used in making calculations.

Metric Units

Meter—Length
Liter —Capacity
Gram —Weight

Metric Prefix to Denote the Order of Units or Fractions of Units

Deka—ten
hecto—hundred
kilo —thousand (In coinage)
deci —one-tenth (dime)
centi —one-one-hundredth (cent)
milli —one one-thousandth (mill)

These prefixes are the same for all the units.

Prefixes which denote increase are of Greek origin, while those denoting a decrease are from the Latin.

Decimal System—	Thousands	Hundreds	Tens	Unit
	1	1	1	1
Metric System —	kilo	hecto	deka	units meter liter gram

Decimal System—	tenths	hundredths	thousandths
	1	1	1
Metric System —	deci	centi	milli

Metric length. The unit of the Metric Length is the meter. This is the basic unit of the metric system and from it are derived the units of weight and capacity.

The distance chosen for the meter was the ten-millionth part of the supposed distance from the equator to the North Pole. It is slightly longer than one yard, 39.37 inches. A Kilometer (one thousand meters) is about ⅝ of a mile.

Meter—Length

Kilometer	1,000 Meters
Hectometer	100 Meters
Dekameter	10 Meters
0.1 m	1 Decimeter
0.01 m	1 Centimeter
0.001 m	1 Millimeter

Metric area and volume. The units of area are the squares of the units of length and the units of volume are the cubes of the units of length.

Metric capacity. The unit of capacity is the liter. This is the capacity of a cube one decimeter on the edge, so that a liter occupies one cubic decimeter of space. A decimeter is made up of ten centimeters so that one may say that a liter occupies one thousand cubic centimeters of space. A milliliter (a thousandth part of a liter) therefore occupies one cubic centimeter of space. The

United States Pharmacopeia formerly used the cubic centimeter to express a thousandth part of a liter. It has now substituted the milliliter. Glass graduates, however, are usually marked in cubic centimeters.

Liter—Capacity

Kiloliter	1,000 Liters
Hectoliter	100 Liters
Dekaliter	10 Liters
0.1 l.	1 Deciliter
0.01 l.	1 Centiliter
0.001 l.	1 Mililiter

Metric weight. The unit of weight is the gram, which is the weight of one cubic centimeter of water or one milliliter of water at 4° Centigrade or 39.2° F. Water is at its greatest density at 4° C. It contracts down to 4° and from that point expands up to the freezing point. It is usual, however, to apply this weight to all liquids where great exactness is not required. Since 1 cubic centimeter weighs 1 gram a liter of water weighs 1,000 grams.

Gram—Weight

Kilogram	1,000 Grams
Hectogram	100 Grams
Dekagram	10 Grams
0.1 gm.	1 Decigram
0.01 gm.	1 Centigram
0.001 gm.	1 Milligram

Metric abbreviations

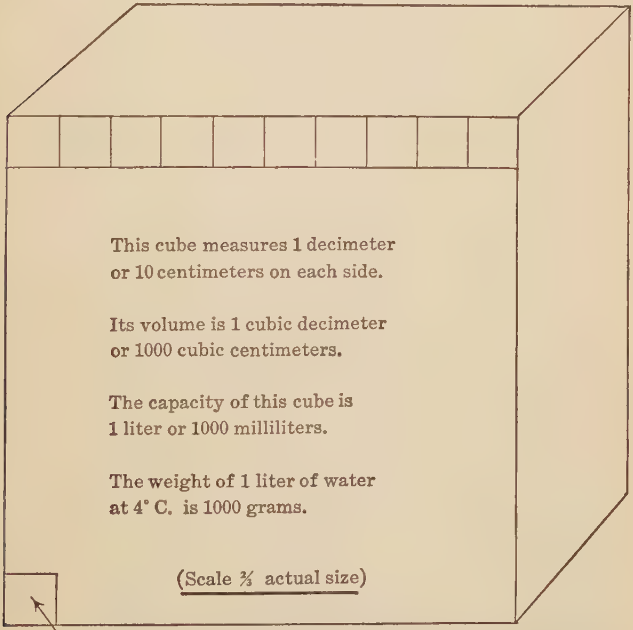
m	Meter
dkm	Dekameter

Metric abbreviations

hm	Hectometer
km	Kilometer
c.m.	Centimeter
c.c.	Cubic Centimeter
dm	Decimeter
mm.	Millimeter

For Weight substitute g. for m., and gram for meter.

For Capacity substitute l. for m., and liter for meter.



This cube measures 1 decimeter or 10 centimeters on each side.

Its volume is 1 cubic decimeter or 1000 cubic centimeters.

The capacity of this cube is 1 liter or 1000 milliliters.

The weight of 1 liter of water at 4° C. is 1000 grams.

(Scale ⅔ actual size)

1 cubic centimeter. A cube of this size contains 1 milliliter of water and the weight of the water would be 1 gram at 4° C.

Approximate equivalents

Metric		*Apothecaries'*
0.065	gram (65 milligrams)	1 grain
0.6	gram (6 decigrams)	10 grains
0.3	gram (3 decigrams)	5 grains
0.015	gram (15 milligrams)	¼ grain
0.0011	gram (11 decimilligrams)	1/60 grain
0.001	gram (1 milligram)	1/64 grain
0.0006	gram (6 decimilligrams)	1/100 grain
1	gram	15 grains
1	c.c. (mil.)	15 minims
4	grams (mils.)	1 dram
4	c.c (mils.)	1 fluid dram
30	c.c. (mils.)	1 fluid ounce
30	grams	1 ounce
500	c.c. (mils.)	1 pint
1,000	c.c. (mils.)	1 quart
1	liter	1 quart
1	kilogram	2.2 lbs. (avoirdupois)

To reduce grams to grains multiply by 15, since there are approximately 15 grains in 1 gram or divide by 0.065.

To reduce grams or c.c. (mils.) to ounces divide by 30, since there are approximately 30 c.c. (30 mils.) or 30 grams in one ounce.

To reduce grains to grams divide by 15 or multiply by 0.065.

To reduce ounces to grams or c.c. (mils.) multiply by 30.

Drill:

1. How many meters in a dekameter? How many dekameters in a hectometer? How many hectometers in a kilometer?

2. What part of a meter is a millimeter? What part of a centimeter is a millimeter? What part of a decimeter is a centimeter?

3. How many units of any metric denomination of length equal one unit of the next higher?

4. Name the metric units of length from meter to kilometer. Name the divisions which signify less than the unit.

5. Read 63.5 m. 16.06 m. .5 m.

6. How many cubic centimeters in a cubic decimeter?

7. Name the metric units of capacity from liter to kiloliter and from milliliter to liter.

How many liters in a kiloliter?

What part of a liter is a milliliter?

8. Read .5 l, 6.5 l, .002 l. How else might you write them?

Reduce 3.6 l to centiliters. .5 l to millimeters.

How many grams in 5 hectograms? 7 kilograms?

9. Give the metric equivalents for the following: gr. 1/64, gr. 1, gr. 15, 1 fluid dram, 1 fluid ounce, 1 pint, 1 quart, gr. 1/120, gr. 1/50, gr. 1/200.

10. Convert the following to the Apothecaries' System: 4 grams, 1 kilogram, 60 c.c., 30 mg., 0.12 gm., 0.015 gm.

CHAPTER III

SOLUTIONS

Definition. A solution is a clear, homogeneous liquid, having a solid, liquid or gas dissolved in it, so that the dissolved substance is lost to sight as an individual body. If the solid remains visible in the liquid it is known as a suspension. Make a solution of sodium bicarbonate in a test tube and then try to dissolve a few grains of chalk in water and the difference will be readily seen. An emulsion is a solution in which an oil or resin is suspended in water by means of a mucilaginous substance.

The solvent is the liquid which forms the bulk of the solution.

Types of Solvents

Water—aqueous solutions
Ether—ethereal solutions
Alcohol—alcoholic solutions
Glycerine—glycerites
Dilute Acetic Acid—vinegars

The solute is the dissolved substance and may be a solid, liquid or gas.

Solubility. Scientifically no substance is insoluble. The degree of solubility depends on the nature of the solvent, the temperature and the pressure. For example, oil is more soluble in ether than it is in alcohol and is more soluble in alcohol than it is in water. As the temperature increases, usually the solubility increases, except in the case of gases when the solubility usually decreases. Pressure does not have to be considered by the nurse.

Temperature. By temperature is meant the intensity of heat of a body. This intensity may be measured by observing the physical action of heat on matter and the instrument used for such measurement is the thermometer. It consists of a glass tube with a fine capillary tube in the center and a bulb at the end. Air is removed from the upper part of the tube and a liquid, usually mercury, is introduced into the bulb. Liquids are used to observe the physical action of the heat, as the expansion of solids is too small and that of gases too great. Mercury is usually used, as it only boils at a very high temperature. After the liquid is introduced into the bulb, the tube is hermetically sealed. The tube is graduated, the two fixed points being boiling point and freezing point.

There are three scales, the Fahrenheit scale, the Centigrade scale and the Réaumur scale. The nurse is interested in the first two and she should be able to convert one into the other. In the Fahrenheit scale, the boiling point of water is 212° F. at ordinary atmospheric pressure and the freezing point is 32° F., the difference between the two points being 180°. In the Centigrade scale there are one hundred degrees between boiling point and freezing point, the former being 100° C. and the latter 0° C.

Conversion from one scale to the other: Taking the difference between freezing point and boiling point in the Centigrade scale, there are 100° and in the Fahrenheit scale 180°, thus 1 degree Centigrade is equal to $9/5$ of a degree Fahrenheit and inversely 1 degree Fahrenheit is equal to $5/9$ of a degree Centigrade.

$$\frac{180}{100} = \frac{9}{5} \qquad \frac{100}{180} = \frac{5}{9}$$

To convert Fahrenheit to Centigrade, the number 32 must first be subtracted in order that the degrees may count from the same point on the scale, and then multiplied by $5/9$ since 1 degree F. is only equal to $5/9$ of a degree Centigrade.

Formula: $C = \frac{5}{9}\,(F-32)$

Example: Convert 98.6° F. to Centigrade.

$$\frac{5}{9} \times (98.6 - 32)\ 66.6 = \frac{333.0}{9} = 37°\ C.$$

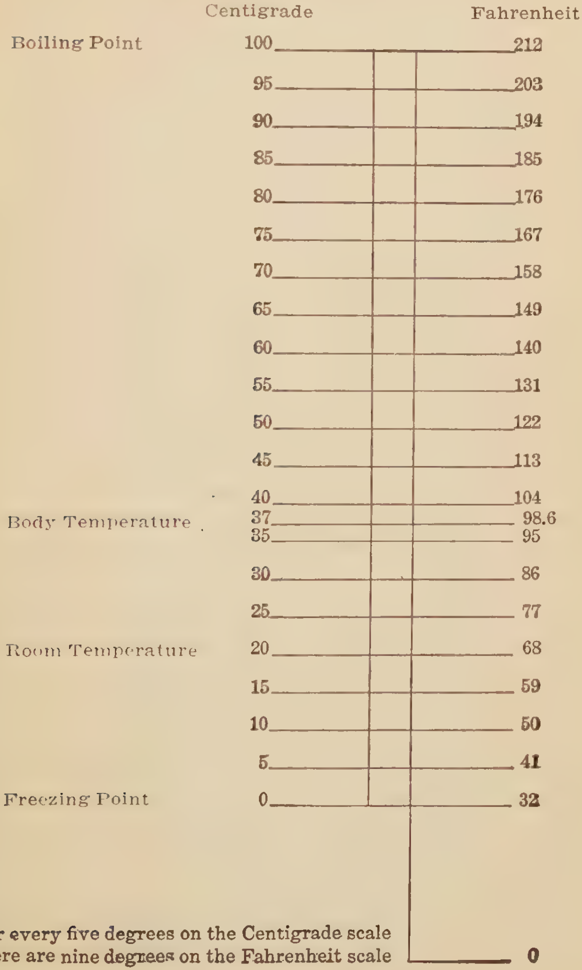
To convert Centigrade to Fahrenheit:

Since 1° C. is equal to $9/5$ of a degree Fahrenheit, the Centigrade temperature is multiplied by $9/5$. The number 32 must then be added since there are no degrees on the Centigrade scale which correspond to the 32 degrees below freezing point on the Fahrenheit scale.

Formula: $F = \frac{9}{5}C + 32$

Example: Convert 37° C. to Fahrenheit.

$$37 \times \frac{9}{5} = \frac{333}{5} = 66.6 + 32 = 98.6 \text{ F.}$$



For every five degrees on the Centigrade scale there are nine degrees on the Fahrenheit scale

Boiling Point and Freezing Point in Solutions.

The boiling point of non-volatile substances in solution is higher than that of water, while the freezing point is lower. For example: water saturated with common salt boils at 109° C. If a volatile substance is used, such as a solution of alcohol and water, the boiling point is lowered.

Saturation. A solution is said to be saturated when the solvent has taken up all the solute that it can at a given temperature. This is called the saturation point and is expressed in per cent. For example: the saturation point of potassium permanganate at room temperature is 6%. If more solute is added at that temperature it will crystallize.

A supersaturated solution is one which holds in solution the same amount of solute when the temperature is lowered as it did at a higher temperature. For example: Boric acid at room temperature is saturated at 5%. By using boiling water 25% will dissolve; if this 25% remained in solution when the solution cooled to room temperature it would be a supersaturated solution. But it will not. There are few solutions which ~~can be~~ supersaturated and great care has to be taken not to disturb them. The slightest jar would cause the extra solute to crystallize, leaving a saturated solution.

Strength of a Solution. The strength of a solution is the per cent of solute by weight which has been dissolved in making a given amount of solution.

It may be expressed in per cent, in common fractions or in ratio. It is very simple to change quickly from one to the other and one's ability to make solutions accurately will depend on a knowledge of very elementary arithmetic.

A review is therefore given here which will cover the material necessary for an understanding of the principles involved. Solutions to be absolutely accurate should be made by weight, but those that the nurse will be called upon to prepare will be sufficiently accurate if made by volume.

Drams and ounces in weight may be used as complementary to fluid drams and fluid ounces and the minim used as complementary to the grain. This is not accurate and so far as possible drugs should be weighed. A pure drug is 100% and all powders and crystals which are unadulterated are considered as pure drugs. In liquids, Lysol, Phenol, Cresol, Creolin and Alcohol are considered as 100%.

CHAPTER IV

ARITHMETIC REVIEW

Fractions. If an orange be divided into four equal parts, what part of the whole will one piece be? Such parts of a unit as one-half, two-thirds, three-fourths, are called fractions. A fraction may be expressed in figures by writing the figure denoting the number of equal parts into which the unit is divided below a short horizontal line $\overline{6}$, and the number of equal parts taken above the same line $\underline{5}$. Thus ⅚ expresses five-sixths of a unit.

If we have gr. ⅓ ordered, it means that a grain has to be divided into three equal parts and one part given.

A fraction is therefore one or more of the equal parts of a unit. The denominator of a fraction, or the figure under the line, is the number of equal parts into which the faction is divided. The numerator, or the figure over the line, is the number of equal parts taken.

Common Fraction. A common fraction is a fraction that results from the division of a unit into any number of equal parts. If the unit is divided into tenths, hundredths, thousandths, it is called a decimal fraction and may be written in three ways—in words, in the form of a common fraction, such as $\frac{3}{10}$ or in decimal form .3.

As the denominator increases, the value of a fraction decreases:

$$\frac{1}{200} \text{ is of more value than } \frac{1}{2000}$$

Addition of Fractions. A patient has been given morphine sulphate grain $\frac{1}{8}$, grain $\frac{1}{8}$, grain $\frac{1}{6}$ and grain $\frac{1}{4}$ during 24 hours. How much morphine sulphate has the patient received? Change the fractions to equivalent fractions with a common denominator. Find the sum of the numerators and write it over the common denominator. Reduce the new fraction to lowest terms.

$$\frac{1}{8} + \frac{1}{8} + \frac{1}{6} + \frac{1}{4} = \frac{3}{24} + \frac{3}{24} + \frac{4}{24} + \frac{6}{24} = \frac{16}{24} = \frac{2}{3}$$

The patient has received gr. $\frac{2}{3}$ in 24 hours.

Multiplication of Fractions. To multiply a fraction by an integer (whole number) multiply the numerator by the integer and divide the product by the denominator.

We have 10 ounces of a solution of carbolic acid and $\frac{5}{100}$ of it is carbolic acid. How much carbolic acid was used in making the solution?

$$\frac{5}{100} \times 10 \text{ ounces} = \frac{50}{100} = \frac{1}{2} \text{ ounce.}$$

We may shorten the work by dividing numerator and denominator by any factor common to both before multiplying.

$$\frac{\overset{1}{\cancel{5}}}{\underset{\underset{2}{\cancel{20}}}{\cancel{100}}} \times \overset{1}{\cancel{10}} = \frac{1}{2}$$

To multiply a fraction by a fraction multiply the numerators together for a new numerator and multiply the denominators for a new denominator.

$$\frac{1}{3} \times \frac{1}{4} = \frac{1}{12}$$

Division of Fractions. In dividing a fraction by a fraction invert the terms of the divisor and proceed as in multiplying fractions.

A man has ⅓ of a barrel of flour and desires to give his neighbor ⅙ of a barrel. How much of the ⅓ will he give him?

We must find what part of ⅓, ⅙ is, so we will divide the amount desired by the amount we have:

$$\frac{1}{6} \div \frac{1}{3} = \frac{1}{6} \times \frac{3}{1} = \frac{1}{2}$$

We find he would give his neighbor ½ of what he had.

Complex Fraction. A complex fraction is an expressed division of fractions, such as

$$\frac{\frac{1}{1000}}{\frac{10}{20}}$$

It is reduced to its simplest form by performing the division as expressed:

$$\frac{1}{1000} \div \frac{10}{20} = \frac{1}{1000} \times \frac{20}{10} = \frac{2}{1000}$$

A fraction is reduced to lower terms by dividing both the numerator and the denominator by the greatest common divisor:

$$\frac{2}{1000} = \frac{1}{500}$$

If in a complex fraction both denominators are 100, the fraction can be simplified immediately by cancellation:

$$\frac{\frac{5}{\cancel{1}\cancel{0}\cancel{0}}}{\frac{20}{\cancel{1}\cancel{0}\cancel{0}}} = \frac{5}{20} = \frac{1}{4}$$

Example: We have grain $\frac{1}{20}$ of a drug and we desire to give grain $\frac{1}{60}$. In other words, we want to find out what part grain $\frac{1}{60}$ is of grain $\frac{1}{20}$. Expressed as a complex fraction we have:

$$\frac{\text{Desire } \frac{1}{60}}{\text{Have } \frac{1}{20}} = \frac{1}{60} \times \frac{20}{1} = \frac{1}{3}$$

We find that grain $\frac{1}{60}$ is $\frac{1}{3}$ of grain $\frac{1}{20}$.

Percentage. Per cent means hundredths. One per cent of a number is one one-hundredth of it, two per cent two one-hundredths, and so on. The sign % is often used for the word "per cent." We can express it 5% or decimally .05 or in fractions $^5/_{100}$.

If we have $1,000 in the bank at 5% interest and we wish to know how much money we are to receive as interest at the end of the year, we multiply $1,000 by .05 or $^5/_{100}$. Likewise if we want 25 ounces of phenol solution, and we want it 5% in strength, we will find out how much phenol to use in making it by the same method as we find out how much interest the bank pays us on our principal.

$$\frac{5}{100} \times 25 \text{ ounces} = \frac{125}{100} = 1\,^1/_4 \text{ ounces of phenol.}$$

Ratio. If we have a solution of bichloride of mercury 1-1000 it means that in every thousand parts of that bichloride solution there is one part of drug. The amount of drug is compared to 1 as a fixed basis. It may be written as a fraction $^1/_{1000}$. In any quantity of the solution the amount of solute would be in the same relation to the whole as 1 bears to 1,000, or in other words, the ratio shows the relation between the solute and the whole solution. If we have 5 ounces of a 1-20 solution of Lysol, the drug is one-twentieth of the whole solution.

$$\frac{1}{20} \times 5 \text{ ounces} = \frac{1}{4} \text{ ounce drug (Lysol)}$$

$^1/_4 \times 20 = 5$ ounces, proving that the drug forms one-twentieth of the whole solution.

To change per cent to a fraction, decimal or ratio:

To a fraction:

Write the per cent as numerator and 100 for denominator:

$$\begin{array}{ccccc} 5\% & 6\% & 10\% & 12\% & 12\frac{1}{2}\% \\ \frac{5}{100} & \frac{6}{100} & \frac{10}{100} & \frac{12}{100} & \frac{12\frac{1}{2}}{100} \end{array}$$

Reduced to simple fractions:

$$\begin{array}{ccccc} \frac{1}{20} & \frac{3}{50} & \frac{1}{10} & \frac{3}{25} & \frac{1}{8} \end{array}$$

To ratio:

Follow the same method. Reduce to simple fraction and write in ratio form:

$5\% = 5/100 = 1/20$ or 1:20 or as is sometimes written 1–20.

To decimals:

Omit per cent sign and express as hundredths decimally:

$$5\% = .05$$

Fractions to per cent or ratio to per cent:

Divide numerator by the denominator and write the decimal in the per cent form:

$$\frac{1}{50} \quad \frac{1.00}{50} = .02 \text{ or } 2\%$$

Ratio to per cent:

Write as a common fraction and then reduce the fraction to the per cent form:

$$1\text{–}50 \quad \frac{1}{50} = .02 = 2\%.$$

In changing fractions of 1 per cent to ratio or fractions, add two zeros to the denominator, as

.1% $\frac{1}{10}$% 1–1000
.9% $\frac{9}{10}$% 9–1000
.2% $\frac{1}{5}$% 1–500
.5% $\frac{1}{2}$% 1–200

Drill:

1. A patient received gr. 1/15, gr. 1/20 and gr. 1/30 of drug. How much did he receive?

2. A received gr. 1/120, gr. 1/100 and gr. 1/200. B received gr. 1/50, gr. 1/60 and gr. 1/100. How much did each receive and who received most?

3. A tablet contains gr. 1/20. It is desired to give gr. 1/40. How much of the tablet on hand will you give?

4. Write 20% in as many ways as possible. 1%, 3%, 6%, ½%, .1%, and .4%.

5. Using fractions what is 5% of 200 ounces? Using fractions what is 3% of 1 quart?

6. Using fractions what is 4% of 50 drams? Using fractions what is 6% of 1 liter?

7. Using fractions what is ½% of 2 quarts? Using fractions what is 2/10% of 25 ounces?

8. Using fractions what is 1/2% of 2 quarts? Using fractions what is 2/10% of 1 quart?

Note. It will be necessary to reduce quarts, liters, etc., to smaller terms.

9. Divide 1/1000 by 1/500.

10. Divide 3/100 by 6/100.

11. You have a 4 ounce mixture containing gr. 1/2 of strychnine. How much strychnine will the patient get with each dram?

Start

CHAPTER V

THE ARITHMETIC OF SOLUTIONS

Solutions from pure drug.

1. **Problem:** To make a solution of given per cent from pure drug:

Example: Make 1 pint or 500 c.c. of a 1% solution of sodium bicarbonate.

1 pint equals 7,680 minims or 500 c.c.
1% desired per cent
100% we have, since we are to use pure sodium bicarbonate.

In our arithmetical review it was found that a per cent could be changed to a common fraction and if we desired 1% of any number we multiplied that number by 1/100. The denominator represents the complete unit which has been divided and the numerator, the part we desire. We also found in our review that if we want to find the relation between two numbers, we divide what we desire by what we have. These are two ways of expressing the same thing and are given thus to show the rationale of working a number of different types of problems by the same method.

Desire 1%—or desired part of unit
Have 100% or whole unit

$$\frac{1}{100} \times 7{,}680 \text{ minims} = 76.80$$

In the metric system

$$\frac{1}{100} \times 500 \text{ c.c.} = 5 \text{ c.c.}$$

Since 1 c.c. of water weighs 1 gram we can translate c.c. into grams.

The division is simply performed by placing a decimal point two places to the left.

76 grains or 1¼ drams (60 grains to dram) of drug, water to one pint or 5 grams of drug, water to 500 c.c. make a 1% solution.

We have divided what we **desire** by what we **have** to find the part of the whole Quantity which is to be drug and multiplied it by the **Quantity.** From this we derive the formula:

$$\frac{\text{Desire } \%}{\text{Have } \%} \times \text{Quantity} = \text{quantity of drug to be}$$

used.

or abbreviated

$$\frac{D}{H} \times Q = q$$

(These letters appear in the same order as in the alphabet).

Note: It will be necessary to change the Quantity to lower terms, ounces, drams or minims, in many instances. If a small quantity of a weak solution, it is usually necessary to change to minims. In the metric system the Quantity is usually expressed in cubic centimeters.

Example: How much drug will it take to make 1 ounce or 30 c.c. of 1% solution of lysol?

1 ounce = 480 minims

$$\begin{array}{l} \text{Desire} \\ \text{Have} \end{array} \frac{1}{100} \times 480 \text{ ♏} = 4.8 \text{ ♏}$$

approximately 5 minims of drug, water to one ounce, make a 1% solution.

In the metric system

$$\frac{1}{100} \times 30 \text{ c.c.} = 0.3 \text{ c.c.}$$

0.3 c.c. of drug, water to 30 c.c.

(5 grains of drug, water to one ounce or 0.3 gram of drug, water to 30 c.c. make a 1% solution if the drug is solid).

Example: Make 1 pint or 500 c.c. of .1% solution (1–1000) of bichloride of mercury.

1 Pint = 7,680 minims

$$\frac{.1}{100} \times 7{,}680 = 7.68 \text{ grains}$$

In the metric system

$$\frac{.1}{100} \times 500 \text{ c.c.} = 0.5 \text{ c.c.}$$

7.68 grs. or approximately 7½ grs. of drug, water to one pint or 0.5 gram of drug, water to 500 c.c. make a 1–1000 solution.

To be memorized for ready reference:

In the apothecaries system:

5 grs. of drug, water to one ounce, make a 1% solution.
76 grs. or 1¼ drams of drug, water to one pint, make a 1% solution.
7.6 grs. or 7½ gr. of drug, water to one pint, make a .1% solution (or 1–1000 solution).
If the drug is a liquid change grains to minims.

In the metric system:

0.3 gram of drug, water to 30 c.c., make a 1% solution.
5.0 grams of drug, water to 500 c.c., make a 1% solution.
0.5 gram of drug, water to 500 c.c., make a .1% solution or a 1–1000 solution.
If the drug is a liquid change grams to c.c.

Example: Make 3 pints of 5% solution of glucose
1 pint = 128 drams
3 pints = 384 drams
$\frac{5}{100} \times 384 = 19.20$ . . . $19\frac{2}{10}$ drams
1 dram = 60 grains. 8 drams = 1 ounce
$\frac{2}{10} \times 60 = 12$ grains. 19 drams = 2 ounces, 3 drams
Answer—2 ounces, 3 drams, 12 grains.
Water to 3 pints

In the metric system:

$$\frac{5}{100} \times 1500 \text{ c.c.} = 75 \text{ c.c or } 75 \text{ grams,}$$

water to 1500 c.c.

Example: Make a liter of 4% boric acid.

1 liter = 1000 c.c.

$$\frac{4}{100} \times 1000 \text{ c.c.} = 40 \text{ c.c. or } 40 \text{ grams}$$

Water to one liter.

DRILL:

1. Make 12 ounces of 2% lysol solution.
2. Make 0 IV of 1% creolin solution.
3. How many minims of carbolic acid would be required to make 2 ounces of a ¼% solution?
4. How many grains of potassium permanganate will be required to make 1 quart of a 1/10% solution?
5. Make a liter of .2% bichloride of mercury.
6. How many grams of silver nitrate are contained in 100 mils. of a 3% solution?

2. **Problem:** To make a solution of a given ratio from pure drug:

Example: Make 8 ounces or 250 c.c. of a 1–1000 solution of bichloride of mercury.

We are to make a solution, the strength of which is expressed in ratio, from pure drug. We desire a 1–1000 solution. Our drug is 100% but we must express it in the same terms as the solution we desire. It is 1-1 or 100-100. Write these both as common fractions, $\frac{1}{1000}$ and $\frac{1}{1}$. Follow the general rule.

Divide what you desire by what you have and multiply by the Quantity.

8 ounces = 3,840 minims, or 250 c.c.

$$\frac{\frac{1}{1000}}{\frac{1}{1}} = \frac{1}{1000} \times 3{,}840 \text{ minims} = 3.84 \text{ or approximately } 3\tfrac{3}{4} \text{ grains}$$

Answer: 3¾ grains of bichloride, water to 8 ounces.

$$\frac{1}{1000} \times 250 \text{ c.c.} = \frac{1}{4} = 0.25 \text{ gram, water to } 250 \text{ c.c.}$$

It is readily seen that when we are making a solution, the strength of which is expressed in ratio, from pure drug, it is necessary only to multiply the ratio expressed as a fraction by the Quantity and thus save time.

Example: Make 2 quarts of 1–5000 potassium permanganate

1 pint = 7,680 minims. 4 pints or 2 quarts = 30,720 minims, or 2000 c.c.

$$\frac{1}{5000} \times 30{,}720 = 6\,\frac{72}{500} \text{ grains.} \quad 6 \text{ grains}$$

Do the same problem in the metric system:

$$\frac{1}{5\cancel{0}\cancel{0}\cancel{0}} \times 2\cancel{0}\cancel{0}\cancel{0} = \frac{2}{5} \text{ gram}$$

(1 gram = 10 decigrams — ⅖ gram = 4 decigrams = .4 gram

Answer .4 gram, water to two liters.

DRILL:

1. Make a quart of 1-5000 potassium permanganate solution.
2. Make a pint of 1-25 boric acid solution.
3. Make 2 ounces of 1-20 carbolic acid solution.
4. Make a gallon of 1-50 sodium bicarbonate solution.
5. Make a liter of 1-4000 bichloride of mercury solution.
6. Make 200 c.c. of ¼% silver nitrate solution.

Preparation of solutions from stock solutions. It is customary to have stock solutions on hand from which weaker solutions may be made.

1. **Problem:** To make a weaker from a stronger solution when both are expressed in per cent.

Example: Make a quart or 1 liter of 2% lysol from a 10% solution.

If we changed our per cent into common fractions we would have $\frac{2}{100}$ and $\frac{10}{100}$. We want to find the relation between the two.

Express as complex fraction $\dfrac{\frac{2}{\cancel{100}}}{\frac{10}{\cancel{100}}}$. The denominators are alike, so that we can simplify this immediately—

$$\frac{\text{Desire}}{\text{Have}}\ \frac{2}{10} \times 32 = 6\tfrac{4}{10} \text{ ounces}$$

480 minims = 1 ounce. $\frac{4}{10}$ of 480 = 192 minims or 3 drams, 12 minims.

here

Answer: 6 oz. 3 drams, 12 minims of 10% solution. Water to 1 quart.

In the metric system

$$\frac{2}{10} \times 1000 \text{ c.c.} = 200 \text{ c.c., of } 10\% \text{ solution}$$

Water to 1 liter

here

1. From stock solution of 5% carbolic solution make 8 ounces of 1%.

2. From stock solution of 40% formaldehyde make 3 pints of 2%.

3. From stock solution of 10% lysol make a gallon of ½%.

4. How much 25% solution of phenol is needed to make 30 mils. of 5% solution?

5. How much of a 6% potassium permanganate solution is needed to make 2 liters of .2% solution?

6. Make a liter of .9% salt solution from stock solution which is 10%.

2. **Problem:** To make a weaker from a stronger solution when both are expressed in ratio:

Example: Make a pint or 500 c.c. of potassium permanganate 1-5000 from stock solution 1-30.

Find the relation between what is desired and what we have, as before. The problem will be

$$\frac{\text{Desire}\ \frac{1}{5000}}{\text{Have}\ \frac{1}{30}} \times 7{,}680 \text{ minims}$$

$$\frac{1}{5000} \times \frac{30}{1} \times 7{,}680 = \begin{array}{l}\text{46 minims of 1-30 solution}\\ \text{Water to 1 pint}\end{array}$$

In the metric system

$$\frac{1}{5000} \times \frac{30}{1} \times 500 \text{ c.c.} = \begin{array}{l}\text{3 c.c. of 1-30 solution,}\\ \quad\text{water to 500 c.c.}\end{array}$$

Formula.

$$\frac{\text{Desired per cent or ratio expressed as fraction}}{\text{Have per cent or ratio expressed as fraction}} \times \text{Quantity} = \text{q. drug}$$

If one solution is expressed in per cent and one in ratio, change both to the same terms:

Example: Make a quart or 1000 c.c. of ¼% solution from a 1-20.

$\frac{1}{4}\% = 1\text{-}400$ 1 quart = 32 ounces. 8 drams = 1 ounce. 8 × 32 = 256 drams

$$\frac{\text{Desire}\ \frac{1}{400}}{\text{Have}\ \ \frac{1}{20}} \quad \frac{1}{400} \times \frac{20}{1} \times 256 \text{ drams}$$

$$= \frac{256}{20} = 12\frac{4}{5} \text{ drams}$$

$\frac{4}{5} \times 60$ minims = 48 minims. 12 drams = 1½ ounces.

Answer: 1½ ounces, 48 minims of 1-20 solution. Water to 1 quart.

In the metric system:

$$\frac{1}{400} \times \frac{20}{1} \times 1000 \text{ c.c.} = 50 \text{ c.c.}$$

Answer: 50 c.c. of 1-20 solution, water to 1 liter.

DRILL:

1. From 1-30 potassium permanganate make 2 qts. 1–5000 solution.

2. From 1-100 bichloride make 3 pints of 1-4000.

3. From 1-20 carbolic acid solution make 3 ounces of 1-100.

4. From a 25% solution of argyrol make a pint of 1-500.

5. From a 25% solution make 30 mils. of a 1-20.

6. Make a pint of 4% formaldehyde solution from 40% solution, using the metric system.

3. **Problem:** The strength of a solution may be expressed by a certain number of grains to the ounce. This method is not as frequently used as formerly.

Example: We have on hand a solution of silver nitrate containing 48 grains to the ounce. Make 2 ounces of a 2% solution.

Change to ratio—48 grs. to 480 m. (one ounce). We have a 1-10 solution or a 10% solution. Proceed as before:

1 ounce = 8 drams

2 ounces = 16 drams

$$\frac{\text{Desire } 2\ (\%)}{\text{Have } 10\ (\%)} \times 16 \text{ drams} = 3\frac{1}{5} \text{ drams of } 10\%.$$

If both were changed to ratio

$$\frac{\frac{1}{50}}{\frac{1}{10}} = \frac{1}{50} \times \frac{10}{1} \times 16 \text{ drams} = 3\ \frac{1}{5}$$

$$\frac{1}{5} \times 60 = 12 \text{ minims.}$$

Answer: 3 drams, 12 minims of 1-10 solution. Water to 2 ounces.

Miscellaneous.

1. **Problem:** To make solutions from tablets:

Example: Make 1 pint of glucose solution 5% using 10 grain tablets. How many shall you use?

Proceed as ordinarily to make a solution from pure drug and then determine how many tablets will be necessary:

$$\frac{\text{Desire } 5}{\text{Have } 100} \times 7{,}680 = 384$$

384 grains are necessary. 10 grain tablets are on hand—

$$\frac{384}{10} = 38\frac{2}{5} \text{ tablets}$$

Example: Prepare an ounce of 2% solution of cocaine, using tablets gr. ¼.

1 oz. = 480 minims.

$$\frac{\text{Desire } 2}{\text{Have } 100} \times 480 = \frac{96}{\underset{5}{\cancel{10}}} \times \frac{\overset{2}{\cancel{4}}}{1} = \frac{192}{5} = 38\tfrac{2}{5} \text{ tablets}$$

2. **Problem:** To find the number of units of water to add to change a given quantity of solution to a weaker solution. It is more common to make a given amount of solution, but if a problem should arise the procedure is as follows:

Example: How much water must be added to an ounce of a 2% solution of silver nitrate to reduce it to a $\frac{1}{10}$% solution?

Find the relation between desired solution and the solution we have.

Change both to the same terms, in this case to ratio: $\frac{1}{10}\%$ = 1-1000.

$$\frac{\text{Desire } \frac{1}{1000}}{\text{Have } \frac{1}{50}} \quad \frac{1}{1000} \times \frac{50}{1} = \frac{1}{20}$$

The solution we desire is 20 times as weak, therefore to the one ounce of 2% we would add 19 ounces of water and this would give 20 ounces of $\frac{1}{10}\%$. Use one unit of stock solution to 19 units of water for any quantity desired. (See page 99.)

3. **Problem:** To find how much water it would be necessary to add to obtain a solution of given ratio when tablets are used:

Example: How much water would you add to 7½ gr. tablet of bichloride to make a 1-1000 solution? Divide the weight of the tablet by the strength of the solution desired.

$$7\tfrac{1}{2} \text{ gr.} = \frac{15}{2} \times \frac{1000}{1} = \frac{15000}{2} = 7500$$

minims or approximately 1 pint.

In our previous work we found that 7.68 grs. to a pint of water (7,680 minims) made a 1-1000 solution.

Problem: To find the percent of strength of a given amount of solution when the amount of drug it contains is known.

Example: What is the percent of strength of a liter of boric acid solution which contains 40 grams of boric acid?

Divide the quantity of drug used by the total quantity of solution.

$$40 \div 1000 = 40 \times \frac{1}{1000} = \frac{1}{25} = 4\%$$

We can simplify our work usually by making a common fraction, making the quantity of drug used the numerator and the total Quantity of solution the denominator. Reduce to lowest terms. Change the fraction to percent.

To find the ratio of strength of a given quantity of solution when the quantity of drug it contains is known. Proceed as above but do not change the fraction to percent.

DRILL:

1. Express the strength of the following solutions in ratio: 90 c.c. of a solution containing 3 grams of carbolic acid. 100 ounces of a solution containing 2 ounces of boric acid. An ounce of silver nitrate containing 60 grains. 100 c.c. of solution containing 20 c.c. of alcohol. Drams I of solution containing minims XII of argyrol.

2. Express the same in percentage.

3. From a solution of silver nitrate grains LX to ounce, make a quart of 1-1000.

CHAPTER VI

SOLUTIONS IN COMMON USE

COAL TAR DERIVATIVES

As most of the solutions which the nurse is called upon to prepare are used as disinfectants or antiseptics, a summary is here given of those in common use. In some instances only one of a particular class is given in full. Some other preparations which the nurse does not usually prepare but which are mainly for external use are also included.

ARTICLES NECESSARY FOR PREPARATION OF SOLUTIONS.

Drug
Scale with Metric and Apothecaries' Weights.
Pitcher or 2,500 c.c. bottle for solution
Measuring Glass
Minim Glass
Glass Graduate
Glass Stirring Rod
Funnel
Medicine Dropper
Spatula
Tablespoon

Definitions. An **antiseptic** is a chemical which checks the growth of bacteria. A **disinfectant** or

germicide destroys bacteria. A **deodorant** neutralizes disagreeable odors.

Physical methods for destroying bacteria.

- Sunlight inhibits the growth of bacteria.
- Heat destroys bacteria.
  - Moist
    - Water bath
    - Streaming steam
    - Steam under pressure
  - Dry
- Electricity, especially the violet ray, and cold inhibit the growth of many bacteria.
- Drying kills vegetative cells.

Chemicals used.

- Salts of heavy metals
  - Examples, bichloride of mercury, silver nitrate
- Acids and alkalies
  - Examples, hydrochloric acid, sodium hydroxide (lye) boric acid
- Gases
  - Examples, oxygen, formaldehyde
- Halogens
  - Examples, chlorine, iodine from sea weed
- Oxidizing Agents
  - Examples, potassium permanganate, hydrogen peroxide
- Coal Tar Derivatives
  - Examples, phenol, cresol, aniline dyes

Essential Oils
  Examples, thymol, eucalyptol

It is well to call to mind that soap and hot water are efficient means of destroying bacteria.

Factors to be considered in choosing

Efficiency — relationships

Destructiveness

If it is to be used on the skin or mucous membranes it may kill the cells as well as bacteria, it may coagulate the protoplasm, or be absorbed into the circulation and cause toxic symptoms.

Cost: Many disinfectants are very expensive and are no more efficient than those costing much less.

How chemicals act.

a. By oxidation. Example, potassium permanganate.

b. By plasmolysis. Example, strong salt solutions, alcohol ([illegible])

c. By chemical combination with the bacterial cell which destroys it. Example, bichloride of mercury. ([illegible])

d. By dissolving the protoplasm. Example, acids and alkalies.

Factors which influence their efficacy. Many antiseptic solutions become germicidal if they are hot. Moisture is necessary for all classes of chemicals used. The environment of the organism must always be considered.

Conditions which call for their use.

1. To disinfect the hands to promote medical and surgical asepsis.

2. For wounds and sinuses as wet dressings, soaks, poultices.

3. For the local preparation of the skin for surgical procedures.

4. For infected and irritated mucous membranes. Douches and irrigations of ear, eye, nose and throat. Bladder irrigations. Vaginal douches.

5. For the disinfection of discharges from the body.

6. For the disinfection of fomites. Fomites are substances which are capable of holding and transporting infectious microorganisms, such as clothing, books, toys, instruments.

The Coal Tar Derivatives

Source: From coal tar which is obtained by the destructive distillation of soft coal out of contact with the air.

Method of Action: The coal tar antiseptics and disinfectants precipitate protoplasm but do not enter into chemical combination with it. They are, therefore more penetrating than the disinfectants, such as the metallic salts, which form albuminates with protein.

Phenol.

Other names: Carbolic acid.

Physical properties:

a. Colorless, needle-shaped crystals with an aromatic odor.

- *b.* Solubility:
    - 1. 1-20 in water. More soluble in boiling water.
    - 2. All proportions with alcohol.
    - 3. All proportions with glycerine.
    - 4. Liquified phenol. 90% solution. Solutions should be made with hot water.

Chemical and bactericidal properties:

- *a.* Antiseptic: [illegible]
    - 1-850 prevents multiplication of bacteria.
- *b.* Germicide:
    - 5% destroys tubercle bacilli in 24 hours.
    - 1% destroys non-spore forming bacteria in a few minutes at ordinary temperature.

Uses:

- *a.* Gargles and skin lotions, in very dilute solutions.
- *b.* Wet dressings—paralyzes nerve endings ½–1%.
- *c.* Instruments and hardware 1-20.
- *d.* Linen and clothing 1-40 to 1-60.
- *e.* Sinks and toilets 1-20.
- *f.* As a cautery 95% followed by alcohol.

Advantages and disadvantages:

- 1. Advantages:
    - *a.* Efficient as a germicide.
    - *b.* Does not stain linen, paint.
    - *c.* Does not injure wood or metal.
    - *d.* Dilute solution paralyzes nerve endings and thus relieves pain.

2. Disadvantages: [illegible]
    - *a.* Expensive.
    - *b.* Escharotic on skin.
    - *c.* Danger of gangrene with wet dressings.
    - *d.* Very poisonous.
    - *e.* Injures marble.

Poisoning: [illegible]

1. Symptoms:
    - *a.* Burning of mouth and throat.
    - *b.* Pain in stomach.
    - *c.* Nausea and vomiting with mucus.
    - *d.* Dark green urine which is scanty in amount.
    - *e.* Headache and dizziness.
    - *f.* Drowsiness and depression which may go on to stupor.
    - *g.* Death will result from paralysis of the respiratory centre.
2. Treatment:
    - *a.* Dilute alcohol (20%) as phenol is more soluble in alcohol than in body fluids. Follow with lavage. [illegible]
    - *b.* 1 oz. Magnesium sulphate, which forms sulpho-carbolates which are non-poisonous salts of phenol.
    - *c.* Lime water with milk.
3. External Burns: Use alcohol freely.

Dobell's Solution, used as a gargle and for nasal irrigations, contains a small quantity of Phenol, as well as sodium borate sodium bicarbonate, glycerine, and water.

Phenol co-efficient: Phenol is used as a standard and the phenol co-efficient is the relative strength of a disinfectant as compared with a solution of phenol acting on same organism and for same length of time.

Cresol Preparations.

Tri-Cresol:

Physical properties:

- *a*. Straw-colored liquid, thick, heavy.
- *b*. Phenol-like odor.
- *c*. Soluble in water 1-60. More soluble in hot water. Solutions should be made with hot water.

Chemical and bactericidal properties:

- *a*. Four times as strong as phenol.
- *b*. Antiseptic in less than 2% solutions.
- *c*. Germicidal, 2%.
- *d*. Deodorant.

Other forms:

- *a*. Liquor cresolis compositus.
- *b*. Creolin.
  Lysol.
  - (1) Emulsions of cresol in soap solution.
  - (2) Trade preparations.

Uses of cresol preparations:

- *a*. Hands 1–2%.
- *b*. Infected conditions 2%.
- *c*. Soaks and poultices 1–2%.

- *d.* Douches ¼% to 1% (mucous membranes)
- *e.* Sinks, excreta, toilets 2%.

Advantages:

- *a.* Effective germicide in relatively weak solutions.
- *b.* Does not stain.

Poisoning:

Symptoms: As in phenol poisoning.

Other Coal Tar Derivatives:

Picric Acid. A yellow crystalline powder, soluble in water. A saturated solution, 1.2%, is used for burns and superficial wounds. It is soluble in alcohol up to 10%. Some surgeons use a 5% alcoholic solution for disinfecting the skin prior to operation. It may cause poisoning due to absorption from the skin.

Resorcinol. A 10% solution is used in the treatment of dandruff. It is also used in skin lotions as an anti-pruritic and antiseptic.

Coal Tar Dyes.

Method of Action: The aniline dyes have a chemical affinity for protein and are germicidal.

Acriflavine, Neutral.

Proflavine.

Uses:

- *a.* For irrigating wounds, 1-1000 to 1-5000, made with normal salt solution as the solvent.
- *b.* Intravenously in septecemia, 1-200.
- *c.* For irrigations of the urinary tract in gonorrheal infections, 1-1000 to 1-6000.

d. In otitis media 1-500.

Solutions must be fresh.

Gentian Violet. anilin

Uses:

1. Given intravenously in septecemia 1%.
2. In cystitis 1-2%.

CHAPTER VII

SOLUTIONS IN COMMON USE

METALLIC SALTS

OXIDIZING AGENTS—THE HALOGENS

Method of Action: The salts of the heavy metals, such as mercury, lead, silver, copper, precipitate the albumin of the bacterial cell, forming an albuminate. This precipitation somewhat limits their action as germicides for material where there is much protein present, such as the body excretions.

Bichloride of Mercury ($HgCl_2$).

Source: Salt of mercury. Made commercially by heating common salt and mercuric sulphate.

Other names: $Hg\,Cl$ = (calomel)

- *a.* Corrosive sublimate.
- *b.* Mercuric chloride.
- *c.* Hydrargyri chloridum corrosivum.

Physical properties:

- *a.* White crystals. (Usually sold in compressed tablets.)
- *b.* Metallic taste.
- *c.* Soluble in water 1-13.
- *d.* Soluble in alcohol 1-3.

Coal tar product of distillation of coal.

Chemical and bactericidal properties:

- *a.* Germicide. Destroys all forms of microbial life in relatively weak solutions. 1-1000 kills non-spore bearing bacilli in ½ hr. 1-300,000 inhibits growth of many bacteria.
- *b.* Precipitates protein.
- *c.* Does not penetrate oily surfaces.
- *d.* Inert with alkali.

Uses:

- *a.* Hands (1-3,000-5,000).
- *b.* Bath after scarlet fever (1-10,000).
- *c.* Wounds (1-4,000–1-10,000).
- *d.* Douches, vaginal (1-5,000–1-10,000):
  1. Not used for douches in obstetrics because it dries the mucous membrane.
  2. Used for vaginal dressings in obstetrics.
- *e.* Enamel, glassware, etc.

Advantages:

- *a.* Extremely efficient in weak solutions.
- *b.* Comparatively cheap.

Disadvantages:

- *a.* Limited use because of its action with albumin.
- *b.* If too strong destroys cells and promotes exudation.
- *c.* Stains and corrodes metal.
- *d.* Danger of dermatitis.
- *e.* Very poisonous.

Poisoning:

- *a.* May be absorbed through skin and mucous membrane.
- *b.* Taken by mouth with suicidal intent.

Symptoms:

- *a.* Nausea and vomiting.
- *b.* Increase in saliva.
- *c.* Swelling and ulceration of gums and mouth.
- *d.* Gastro-intestinal irritation.

First aid treatment:

- *a.* White of egg—1 egg to every 4 grains
- *b.* Milk.

Mercurochrome 220 soluble.

Source: A salt of mercury, bromine and fluorscein.

Physical properties:

- *a.* Occurs as irridescent scales or granules.
- *b.* Readily soluble in water forming a deep red solution.

Chemical and bactericidal properties:

- *a.* Does not precipitate protein.
- *b.* Contains 23–24% mercury.
- *c.* Incompatible with oxidizing agents.
- *d.* Germicidal in 2% solutions.

Uses:

- *a.* Infections of the genito-urinary tract 1–2%.
- *b.* In otitis media 2%.
- *c.* In throat infections 2%.

Advantages:

- *a.* Non-irritating
- *b.* Penetrating

Disadvantages:

- *a.* Stains the skin.
- *b.* Stains linen.

Stains on the skin may be removed by a 2% solution of potassium permanganate followed by a 5% solution of oxalic acid. Stains on linen may be removed by a 25% Labarraque's Solution followed by a 5% solution of Acetic Acid.

Silver Compounds:

Silver nitrate ($AgNO_3$).

Source: Prepared by dissolving silver in nitric acid.

Other names: Lunar caustic.

Physical properties:

- *a.* Colorless crystals, which become gray or grayish black on exposure to light in contact with organic matter.
- *b.* Soluble in water and alcohol.

Chemical and bactericidal properties:

- *a.* Antiseptic 1-10000.
- *b.* Germicide 1-1000.
- *c.* Reacts with soluble chlorides, iodides and bromides and for this reason solutions of silver nitrate should always be made with warm distilled water. Ordinary tap water may contain soluble chlorides with which it would react.
- *d.* Caustic to skin and mucous membranes.

Burns
[illegible]

Uses:

- *a.* As a caustic for wounds, ulcers and excess granulations, fused silver nitrate is used and must be moistened before use.
- *b.* Conjunctivitis 0.2–2%. Ophthalmia neonatorum. As a ~~prophylaxis~~ in the eyes of the new born: 1 drop of 2% solution. The action of silver nitrate is neutralized by sodium chloride solution. Sodium chloride + silver nitrate → silver chloride (insoluble in water) + sodium nitrate.

  (Eye am)
  leave 1 minute
- *c.* Applications to larynx 2–10%.
- *d.* Irrigations of urethra and bladder 1-2000–1-10000.

  If silver nitrate is used on mucous membrane, a preliminary cleansing should be first given to remove pus, mucus, etc.

Poisoning:

1. Symptoms:
   - *a.* Pain in stomach, throat.
   - *b.* Vomiting. Vomited material usually contains white flakes which blacken on exposure to light.
2. Treatment:
   - *a.* Solution of salt which will react with the silver nitrate to form silver chloride.
   - *b.* Emetic to remove the silver chloride has been precipitated.

Advantages and disadvantages:

1. Advantages: Relatively weak solutions are effective.

2. Disadvantages.
   - *a.* Stains linen. (Stains may be removed by tincture of iodine followed by ammonia and then clear, hot water.)
   - *b.* Stains skin.
   - *c.* May produce a condition known as argyria if absorbed in which the skin turns a dark gray color.

4 to 20%

Organic Silver Preparations: **Argyrol, Protargol, Collargol.**

Colloidal solutions of silver with proteins.

Chemical and Bactericidal Properties:
- *a.* Liberate silver slowly.
- *b.* Incompatible with strong salt solutions.
- *c.* Have the antiseptic action of silver nitrate without its irritating quality.

Uses:
- *a.* For inflammation of mucous membranes.
  - Argyrol, 5–50%.
  - Protargol, ½–10%.
  - Collargol, .2%–1%.
- *b.* As a prophylaxis for ophthalmia neonatorum.

OXIDIZING AGENTS

Oxidizing Agents. substance which gives up oxygen —

Method of Action: The oxidizing agents release oxygen which oxidize the bacteria or the food on which they live.

Hydrogen Peroxide (H_2O_2).

Source: Prepared by treating barium peroxide with sulphuric acid.

Physical properties:

- *a.* Colorless, thick, syrupy liquid.
- *b.* Characteristic odor and taste.
- *c.* What we know is dilute solution, as a concentrated solution would be explosive.

Chemical and bactericidal properties:

- *a.* Has excess oxygen which it gives up.
- *b.* Very unstable. It must be kept in a dark, well-stoppered bottle, in a cool place.
- *c.* Tissues have a catalytic agent which frees the oxygen.

Uses:

- *a.* Suppurating wounds. 1-4 volumes of water to the ordinary solution which is about 3%. Much of its value is in its mechanical action. It unites with and carries off dead tissue and inflammatory matter. It must be used with great care in deep cavities.
- *b.* Gargle.
- *c.* As a bleach. It will bleach organic material and will therefore remove blood stains.

Advantage:

- *a.* In carrying off dead tissue.

Disadvantages:

- *a.* Decomposes readily.
- *b.* Antiseptic value questionable.

Potassium permanganate ($KMnO_4$).

Source: Salt of manganese obtained from potassium manganate by decomposition with water.

Other names: Permanganate of potash.

Physical properties:

- *a.* Dark purple crystals.
- *b.* Claret colored in solution.
- *c.* Sweet astringent taste.
- *d.* Saturated solution 6%.
- *e.* No odor but is a deodorant.

Chemical and bactericidal properties:

- *a.* Has an excess of oxygen which it gives up readily when it comes in contact with organic substances and the oxygen destroys the bacteria. Decomposed solutions have a brown precipitate and should not be used. Oxidizes salts of alkaloids.
- *b.* Decomposes in contact with acids or alkalies.
- *c.* Germicide. Experiments by bacteriologists: 1-833 killed pus cocci in 2 hrs. 5% killed spores in one day. Bacillus of glanders destroyed by 1% solution.

Uses:

- *a.* Irrigating offensive wounds 1–5%.
- *b.* Hands 3% until hands are brown followed by oxalic acid, sterile water.
- *c.* Gargle or mouth wash 1%.
- *d.* Douches 1-5000 to 1%.
- *e.* First aid: 1-2000 for alkaloid poisoning. Care must be taken that no undissolved crystals enter the stomach.
- *f.* Crystals used for snake bite.
- *g.* As a bleach—1-150.

Advantages:

- *a.* Excellent oxidizing agent.

b. Neutralizes odors.

Disadvantages:

a. Decomposes rapidly.
b. Expensive.
c. Stains fabrics (stains may be removed with oxalic acid).

The Halogens and their Compounds.

Chlorine:

Method of Action: Chlorine and its compounds owe their disinfecting power to oxidation. It is believed that the chlorine reacts with the water present and releases nascent oxygen which is the disinfecting agent.

Chlorinated lime ($CaOCl_2$).

Source: Made by the action of chlorine on calcium hydroxide.

Other names: Bleaching powder. Often improperly called chloride of lime. Calx chlorinata.

Physical properties:

a. White, grayish, granular powder.
b. Pungent odor.
c. Partially soluble in water.

Chemical and bactericidal properties:

a. Contains about 30% chlorine.
b. Has an affinity for organic matter.
c. When exposed to air reacts with carbonic acid (carbon dioxide and water) in the air and liberates chlorine, and for this reason should always be kept in tight containers.
d. Germicide 5%.

Uses:

- *a.* Excreta — equal volumes of excreta and stock solution (six ounces to one gallon of water) mixed thoroughly and allowed to stand for two hours.
- *b.* For contaminated drinking water .5%.
- *c.* Swimming pools.
- *d.* Bleach.

Advantages:

- *a.* Effective germicide.
- *b.* Deodorant.

Disadvantages:

- *a.* Corrodes metals and bleaches textiles.
- *b.* Its odor is readily absorbed by food. (This is another reason why it should always be kept in tight containers.)

Dakin's solution.

Source: Fresh solution of sodium hypochlorite (0.45–0.50%) made from chlorinated lime, anhydrous sodium carbonate and sodium bicarbonate.

Physical properties: Clear solution, with odor of chlorinated lime.

Chemical and bactericidal properties:

- *a.* Decomposes when exposed to the light. The solution should be kept in a dark glass bottle.
- *b.* Neutral in reaction.
- *c.* In contact with the tissues it frees chlorine. It dissolves dead tissues, clots, etc., and all vessels must be tied off as there may be a hemorrhage.

d. Disinfectant value is 14–20 times that of phenol.

Uses: Carrel-Dakin method for treatment of wounds. The solution is allowed to flow into the wound through rubber tubes of fine calibre in which holes have been punched on the side. The tubes must be so placed that the liquid runs down and not up into the wound, and the liquid kept in contact with every part of the wound surface. The tubes are held in place with fluffed gauze. The apparatus is arranged with a stop cock so that the solution is allowed to flow in at regular intervals. The skin surrounding the wound must be protected with sterile vaseline or sterile boric ointment. Pain is an indication that the solution has not been prepared properly or it has been allowed to run into the wound with too great force.

Chloramine and Dichloramine are modifications of Dakin's Solution and are used similarly. Chloramine T is used in 1–2% solutions. Dichloramine T is used in 10–15% solutions.

Labarraque's Solution is a solution of chlorinated soda. It is made from chlorinated lime and sodium carbonate and is used for cleaning and disinfecting enamel and glass utensils. It is also used as a bleaching agent.

Iodine (I)

Method of Action: Iodine is believed to form a chemical combination with the bacterial cell rendering it inert. It is very penetrating.

Source: Ashes of Seaweed, Chili saltpeter.

Physical properties:

- *a.* Black shining crystals.
- *b.* When heated gives a violet vapor, hence its name.
- *c.* Slightly soluble in water.
- *d.* Soluble in alcohol.

Used in form of alcoholic solution, 7% iodine, 5% potassium iodide, called tincture of iodine. This, however, is not a true tincture.

Lugol's Solution or Compound Iodine Solution has 5% of iodine dissolved in a 10% solution of potassium iodide.

Bactericidal and chemical properties:

- *a.* Checks the growth of bacteria.
- *b.* Contracts and hardens the skin.
- *c.* Potassium iodide in the solution reacts with other salts. Do not use tincture of iodine on skin which has been treated with bichloride of mercury, as the Potassium Iodide may react with the Bichloride to form red biniodide of mercury.

Uses of Tincture:

- *a.* For local preparation of skin, half strength. Skin must be dry as it will cause blisters if the skin is wet.
- *b.* Counter irritant.
- *c.* Irritation of throat.
- *d.* Cuts and pricks as preventive measure.

Advantages:
- *a.* Good germicide.
- *b.* Valuable in surgical preparation of skin.

Disadvantages:
- *a.* Stains skin and linen. Stains may be removed with alcohol or a paste made of starch and alcohol.
- *b.* Its use as a disinfectant is limited to small areas.

Poisoning:
- *a.* Nausea and vomiting.
- *b.* Diarrhea.
- *c.* Cyanosis.
- *d.* Cold moist skin.
- *e.* Slow shallow breathing.
- *f.* Dilated pupils.

First aid treatment: Boiled starch, milk.

Lugol's Solution is used internally for the prevention and treatment of goitre.

Iodoform is an organic compound containing iodine, used mainly in the form of an ointment or iodoform gauze, for the dressing of wounds. The iodoform may be absorbed and give rise to iodine poisoning.

CHAPTER VIII

MISCELLANEOUS SOLUTIONS IN COMMON USE—GASES, VOLATILE OILS. SOLUTIONS FOR INTERNAL USE

Boric Acid (H_3BO_3)

Source: Found dissolved in the waters of some hot springs, particularly in Italy. Obtained by condensation and evaporation. Also prepared by treating a hot solution of borax with sulphuric acid.

Other names: Boracic acid.

Physical properties:

- *a.* White crystals
- *b.* Slippery feeling
- *c.* Soluble in water, saturated solution at room temperature 5%.
- *d.* Faintly bitter taste.

Chemical and bactericidal properties:

- *a.* Weak acid
- *b.* Mild antiseptic
- *c.* Destroys less resistant bacteria.

Uses:

- *a.* Douches and irrigations 2–4%.
  1. Nasal
  2. Eye

    3. Ear
    4. Vaginal
    5. Bladder
    6. Slightly infected wounds, burns.
  b. Gargles and mouth washes
  c. Used also as a dusting powder and ointment.

Advantages:
  a. Cheap
  b. Non-irritating to tissues.

Disadvantages:
  a. Use limited because of its mildness.

Other solutions which contain boric acid:

Thiersch Solution (Borosal).

Boric Acid and Salicylic Acid in solution.

Used for irrigating wounds.

Liquor Antisepticus.

Contains boric acid, thymol, eucalyptol, methyl salicylate, sodium salicylate, oil of thyme, sodium benzoate, alcohol and water.

Used as a gargle and mouth wash.

Ethyl Alcohol (C_2H_5OH)

Source: Obtained from grain by fermentation.

Other names: Grain alcohol.

Physical properties:
  a. Evaporates readily.
  b. Miscible in all proportions with water.
  c. Characteristic odor and taste.

Chemical and bactericidal properties:
  a. Antiseptic in 50–70% solutions.
  b. Precipitates protein.

Uses (External):

- *a*. Stimulation and hardening of the skin, 50%.
- *b*. Disinfectant for instruments, etc.
- *c*. To disinfect the skin, 70%.
- *d*. As a solvent for organic matter.
- *e*. As an antidote for phenol burns.
- *f*. Absolute alcohol as a laboratory reagent.

Uses (Internal):

- *a*. As an antidote for phenol poisoning, 20%.
- *b*. Found in all tinctures, spirits, wines, fluid extracts.

Poisoning:

- *a*. Marked excitement, talkativeness, staggering gait, flushed face.
- *b*. Drowsiness, stupor.

Treatment:

- *a*. Lavage
- *b*. Cold applications to head
- *c*. Hot coffee
- *d*. External heat
- *e*. Artificial respiration if indicated by slow shallow breathing.

Wood alcohol is methyl alcohol and if taken internally or if its fumes are inhaled it causes severe poisoning.

Formaldehyde (HCHO)

Source: Gas obtained by oxidizing wood alcohol.

Physical properties:

- *a*. Gas.
- *b*. Very irritating to mucous membranes.

c. Soluble in water up to 40%. Formalin is 40% Solution of Formaldehyde.

d. Solution of formaldehyde is clear, colorless. Pungent odor.

e. The gas is only active in the presence of moisture.

Chemical and bactericidal properties:

a. Germicide 1–2%. 1-5000 restrains growth of many organisms.

b. Hardens tissues.

c. Deodorant.

Uses:

a. Room fumigation. Vapor must be generated in tightly closed rooms containing plenty of moisture. Potassium permanganate is used to generate the heat to free the vapor. Fumes are neutralized by ammonia.

b. Disinfecting beds, 2%.

d. Clothing, sheets, etc., 2% for 10 hours.

c. Excreta. Equal amount of 10%. For urine twice as much 10% as urine. Stand one hour.

e. Preservation of specimens, 4%.

Advantages:

a. Powerful germicide.

b. Not very poisonous.

c. Does not bleach nor injure clothing.

Disadvantages:

a. Not very reliable when temperature is below 65° F.

b. Very irritating to mucous membrane and skin.

c. In room disinfection requires much preliminary work and takes a long time.

d. Exposure to light decomposes it.

Sulphur Dioxide (SO_2).

An irritating gas obtained by burning sulphur in the air.

Chemical and bactericidal properties:

a. Insecticide but not very effective for bacteria.

b. Active only in the presence of moisture.

c. Bleaches pigment.

Uses:

a. For room disinfection.—3 lbs. of sulphur for 1000 cubic feet of space. Seal all cracks.

Powdered sulphur or sulphur ointment is used in the treatment of parasitic skin diseases. In this case it owes its action to the formation of sulphides.

Ichthyol is an organic compound of sulphur used in inflammatory conditions of the skin.

Essential or Volatile Oils.

Source: Essential oils are found in definite parts of plants and in many instances gives the characteristic odor to the same. Others, while not existing in the living plant are derived from plant constituents.

Uses:

a. For flavoring.

Examples: Oils of orange, lemon, cinnamon.

b. As antiseptics.

Examples: Oil of thymol, oil of eucalyptol, oil of cloves.

c. As counter-irritants.

Examples: Oil of wintergreen, mustard, oil of turpentine.

d. Certain volatile oils are also used internally as carminatives, anthelmintics and respiratory antiseptics.

Solutions for internal use.

In certain conditions it becomes necessary to introduce a large quantity of solution into a vein (intravenous infusion) or into the subcutaneous tissues (hypodermoclysis). The preparation of these solutions is extremely important, both as to the weighing of the drug and the sterilization of the solutions.

Conditions in which these solutions are given:

1. In acidosis to increase the alkalinity of the blood.
2. In wasting diseases to supply nourishment.
3. In hemorrhage to restore fluid to the body so that the normal blood pressure may be maintained.
4. In shock to stimulate the circulation.
5. In toxic conditions to dilute the toxins and aid in their elimination from the body.

The solutions which are most frequently used are normal salt solution, sodium bicarbonate and glucose.

Sodium bicarbonate ($NaHCO_3$).

Source: Obtained by the interaction of sodium chloride and ammonium-hydrogen carbonate in the Solvay process.

Other names: Sodium hydrogen carbonate. Baking soda.

Physical properties:

a. White, odorless powder.
b. Soluble in water 1–12.

Chemical properties:

a. When in contact with acid liberates carbon dioxide.
b. In solution it is alkaline in reaction as it will hydrolyze sufficiently to give hydroxyl ions which will turn red litmus paper blue. Hydrolysis is not complete.
c. When in solution it is decomposed by high temperature, losing its carbon dioxide and at boiling point it is converted into sodium carbonate (washing soda). Solutions should be made with water well below the boiling point.

Uses:

a. To neutralize excess hydrochloric acid in the stomach.
b. As a mild alkaline wash.
c. Intravenously in acidosis. This solution should be made with sterile water, the powder having been previously exposed to low heat, and all utensils used must be sterile.
d. Colonic irrigations to neutralize acidity.

Disadvantages:

a. Will cause sloughing if injected hypodermically or intramuscularly.

b. Solutions are decomposed by heat.

Sodium chloride (NaCl).

Source: Obtained by evaporating sea water or by allowing water to flow into deposits of rock salt and then pumping the solution to the surface and evaporating the waters.

Other names: Table salt.

Physical properties:

a. White crystals with characteristic taste, "salty."

b. Soluble in water 1-2.8 (36%).

Bactericidal and chemical properties:

a. Mild antiseptic.

b. Stimulates the tissues.

c. Reacts with silver salts and forms silver chloride which is insoluble in water.

Normal salt solution: Normal salt solution is 0.9% ($\frac{9}{10}$%) in strength and has the same osmotic pressure as the blood. This solution is said to be isotonic to the blood. A solution of less osmotic pressure (containing less salt) is a hypotonic solution and its introduction into the blood stream will cause the blood corpuscles, to swell and rupture. This condition is known as hemolysis. A solution of greater osmotic pressure (containing more salt) is a hypertonic solution. This would cause the corpuscles to shrivel and the term applied to this action is crenation. Use is made of hypertonic saline solutions in removing fluid from the body as in edema; for example, the saline cathartics and diuretics.

Uses:

1. As an emetic.
2. Normal salt solution.
   - *a.* To supply fluid to the body in shock and after loss of blood, by intravenous infusion, hypodermoclysis, or proctoclysis.
   - *b.* As a cleansing enema.
   - *c.* As a medium for introducing drugs into the body.
   - *d.* In wounds for cleansing and stimulation of the tissues.
   - *e.* For irrigation of ear, nose, throat, bladder, vagina.
   - *f.* To neutralize silver nitrate in prophylactic treatment of the eyes.
   - *g.* As an antidote for silver nitrate poisoning.

Sterile solutions. Use extreme care in weighing the salt. Use distilled water and filter several times through cotton and then sterilize in an autoclave at 15 lbs. pressure, for sixty minutes after the required pressure has been established. Glassware in which solutions are sterilized should be of the best grade or the extreme heat may cause deposits of silicate to be found in the solution after sterilization.

Other solutions used of which sodium chloride forms a part:

Ringer's solution: Sodium chloride 0.7%. Potassium chloride 0.03%. Calcium chloride 0.025%.

Locke's solution: Sodium chloride 0.9 gm. Potassium chloride 0.042 gm. Calcium chloride 0.024 gm. Sodium bicarbonate 0.03 gm. Dextrose 0.1 gm. Distilled water to 100 c.c.

Dawson's solution: Sodium chloride 0.7%. Sodium bicarbonate 0.5%.

Glucose ($C_6H_{12}O_6$).

Source: Starch is boiled with acid and the solution evaporated.

Other names:

- *a.* Dextrose.
- *b.* Grape sugar.
- *c.* Blood sugar.
- *d.* Simple sugar.

Physical properties:

- *a.* Sweet crystals or syrup (corn syrup).
- *b.* A 5.4% solution is isotonic to the blood.
- *c.* Soluble in water. Solutions should be made with hot water.

Chemical properties:

- *a.* Glucose will reduce cupric hydroxide in Fehling's solution to cuprous oxide which separates as a red precipitate. This solution is therefore used to test for sugar in the urine. Glucose is called a reducing sugar.
- *b.* Oxidized in the body to provide energy.

Uses:

- *a.* Given by intravenous infusion, hypodermoclysis or proctoclysis to provide fluid for the body and also a source of energy, 3–10%. Solutions must be sterilized.

b. In acidosis.

c. Concentrated solutions act as diuretics.

d. Given by mouth before operation as a prophylactic against shock and acidosis. Sodium bicarbonate may be combined with it.

CHAPTER IX

AN INTRODUCTION TO MATERIA MEDICA

WHY AND HOW DRUGS ARE USED

Drugs may be administered for:

- *a.* Direct local effect.
- *b.* Systemic effect.

Conditions in which drugs are used locally:

- *a.* For local conditions of skin and mucous membrane as:
    1. Local infections.
    2. Inflammation.
    3. Wounds.
    4. Irritation.
    5. Relief of pain.
    6. Surgical preparation of skin.
    7. Excess granulations.
- *b.* Local conditions within the body:
    1. To supply an acid or an alkali to stomach. *Example:* Hydrochloric acid to supply a deficiency; sodium bicarbonate given to neutralize acidity.
    2. To cause emesis. *Example:* Mustard and water.

3. To relieve local pain. *Example:* Opium suppositories for hemorrhoids.
4. To bring about catharsis. *Example:* Cascara.
5. To relieve contracted bronchi. *Example:* Steam inhalations.

Methods of administration for local effect:

1. By direct application to skin and mucous membranes.
    - *a.* Solutions used as
        1. Gargles.
        2. Sprays.
        3. Douches.
        4. Irrigations.
        5. Wet dressings.
        6. Baths.
    - *b.* Ointments, pastes, cerates.
    - *c.* Plasters.
    - *d.* Liniments.
    - *e.* Local anesthetics.
2. Local conditions within the body:
    - *a.* Drug given by mouth.
    - *b.* Inhalation.
    - *c.* Suppositories.
    - *d.* Medicated enema.

Terms used to describe local action:

Anodynes are applied locally to relieve pain. *Example:* Oil of gaultheria.

Anesthetics (local) produce insensibility to pain at side of application. *Example:* Cocaine.

Antipruritics are substances used to allay itching.

Astringents are drugs which contract or harden the tissues. *Example:* Tannic acid.

Caustics are substances which burn or destroy tissues. *Example:* Silver nitrate.

Demulcents are agents used to coat and protect the mucous membranes or surfaces of the body. *Example:* Syrup of acacia.

Detergents are drugs used for cleansing wounds. *Example:* Hydrogen peroxide.

Emollients are drugs which soften the surfaces of the body and act as a protection. *Example:* Vaseline.

Rubefacients are drugs which redden the skin by dilating the capillaries. *Example:* Mustard plaster.

Styptics are drugs which check bleeding. *Example:* Adrenalin.

Vesicants are drugs which produce blisters. *Example:* Cantharides.

Vulneraries are drugs which aid in the healing of wounds. *Example:* Scarlet red (non-official).

Systemic effect: All drugs given for systemic effect must eventually reach the blood stream. They either increase or decrease, stimulate or depress the organs of the body or supply deficiencies.

Methods of administration: Methods vary with situation. Certain factors must be considered:

a. Speed of action required.
b. System of body to be acted upon.
c. Diseased condition.
d. Irritating effect on tissues.

1 Intravenously: The drug is dissolved in normal salt solution and put directly into the vein. There is an immediate action.

3 Subcutaneously: Drug is given by hypodermic for quick action or when patient cannot swallow.

2 Intramuscularly: Drugs which may be irritating to subcutaneous tissues may be given deep into the muscle.

4 By mouth: This is the usual way.

6 By inhalation: Volatile drugs only may be given in this way and may be given for local or systemic action.

5 By rectum: Drugs given by rectum are usually given in normal saline or in suppositories.

6 By inunction: Oily or fatty preparations are rubbed into the skin. Skin must be prepared by washing with soap and hot water.

How they reach the blood:

a. Administered directly into the blood stream.
b. Absorbed from stomach and intestines.
c. Absorbed through skin and mucous membranes and subcutaneous tissues.

How drugs act on the cells: Drugs act on the cells which select them. The action may be

a. Physical action. The drug dissolves some of the constituents temporarily.
b. Chemical. Most drugs form chemical combinations with the cells, the exact nature of which is unknown.

c. Salt action.
  1. Sugars.
  2. Acids.
  3. Alkalies.
  4. Salts.

Excretion of drugs: Unutilized drugs are excreted by:

a. Kidneys.
b. Intestines.
c. Lungs.
d. Skin.
e. In the milk of nursing mothers.

Terms used to describe the action of drugs:

Physiological action: The effect of a drug on a normal person.

Therapeutic action: The effect a drug produces in disease.

Synergistic action: The ability of one drug to aid in the action of another.

Antagonistic action: The effect of a drug which is directly opposed to that of another drug.

Side action: An effect which is produced other than that for which the drug is given.

Untoward action: A disagreeable side action.

Toxicological action: The effect which is produced by an overdose.

Cumulative action: Some drugs are very slowly excreted from the body and there is an accumulation of drug which may result in poisonous symptoms and produce a cumulative poisoning.

Classification of effects of drugs given for systemic action.

1. ANALGESICS are drugs used to relieve pain. *Examples:* Opium, morphine. Codeine

2. ANESTHETICS are drugs which cause loss of sensation or insensibility to pain.

General Anesthetics: *Examples:* Ether, nitrous oxide, chloroform.

3. ANTHELMINTICS are drugs which destroy and expel worms. *Examples:* Quassia, santonin, thymol.

4. ANTIPYRETICS are drugs which reduce fever. *Examples:* Phenacetine, acetanilid, quinine. aspirin coal tar

5. ALTERNATIVES are drugs which by some unknown process alter the course of disease and improve the nutrition. *Examples:* Iodides, phosphorus.

6. ANTI-PERIODICS are drugs which oppose the periodic return of symptoms. *Examples:* Quinine, arsenic, salicylates.

7. ANTIDOTES are substances used to counteract the effects of poison.

- *a.* Physical: This is an antidote which surrounds the poison to prevent its absorption and also coats the surface of the tissue. *Examples:* Milk, mashed potato, gruels.
- *b.* Chemical: A chemical change takes place between the antidote and the poison forming a non-poisonous substance. *Example:* A solution of salt for silver nitrate poisoning.
- *c.* Physiological: The antidote produces the opposite systemic effect. *Example:* Caffeine for morphine poisoning.

8. CARMINATIVES are drugs which cause expulsion of gas from the stomach and intestines. *Examples:* Anise, cardamom, ginger, peppermint.

9. CATHARTICS are drugs employed to cause intestinal evacuation. They are sub-divided as follows:

- *a.* Laxatives have a mild action. *Examples:* Cascara sagrada, magnesia, sulphur, fruits, etc.
- *b.* Purgatives are more powerful. *Examples:* Calomel, castor oil, aloes, rhubarb, senna.
- *c.* Drastics have a violent action. *Examples:* Croton oil, jalap, podophyllum.
- *d.* Hydragogues produce copious watery stools. *Examples:* Magnesium sulphate, magnesia citrate and sodium phosphate.

10. CHOLAGOGUES are drugs which are supposed to increase the amount of bile secreted. *Example:* Ox-gall.

11. DIAPHORETICS or SUDORIFICS are drugs which increase the action of the sweat glands and induce perspiration. *Examples:* Pilocarpin, Dover's powder, aconite, salicylates.

12. DIURETICS are drugs which increase the flow of urine. *Examples:* Caffeine, digitalis, potassium salts.

13. EMETICS are drugs which produce vomiting. *Examples:* Apomorphine, ipecac, mustard, zinc sulphate.

14. ECBOLICS or OXYTOXICS are drugs which

stimulate uterine contractions. *Examples:* Quinine, pituitrin.

15. Expectorants are drugs which increase the bronchial secretions and aid in the expulsion of mucus. *Examples:* Ammonium chloride and carbonate, creosote, terpin hydrate.

16. Hypnotics are drugs which produce sleep. *Examples:* Veronal, trional. Ipral Luminal Barbita

17. Mydriatics are drugs which dilate the pupils of the eye. *Example:* Atropine.

18. Myotics are drugs which contract the pupils of the eye. *Example:* Eserin.

19. Sedatives are drugs which lessen the activity of the body. *Examples:* the bromides, opium.

20. Specifics are drugs which have a curative action in certain diseases. *Examples:* Mercury in syphilis, quinine in malaria.

21. Stimulants are drugs which increase the functional activity of an organ. *Examples:* Strychnine, caffeine, are stimulants of the central nervous system.

22. Stomachics or Gastric Tonics are drugs which increase appetite and promote digestion. *Examples:* Gentian, iron, strychnine, quinine.

Time for administration: As a rule the best time for administering a drug is between meals when the stomach is at rest.

There are several exceptions to this rule:

Stomachics which are given to improve the tone of the stomach and to stimulate the secretions should be given at least twenty minutes before meals.

Drugs that act on intestinal digestion should be given an hour after meals when the food is about ready to enter the intestines.

Iron and arsenic preparations, and iodides should be given well diluted after meals. Laxatives and cathartics act more quickly when the stomach is empty. Cathartics which act rapidly and the saline cathartics are usually given before breakfast while those which are slow in action are given at night.

Hypnotics and sedatives should be given after all other treatments have been completed so that nothing may interfere with the desired effect.

Drugs that act slowly must be given a corresponding length of time before the hour for sleep.

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CHAPTER X

DOSAGE

Definition. Posology is the study of the dosage of drugs. The physician is responsible for the amount of drug ordered, but the nurse should be sufficiently familiar with average doses to be able to detect an error and to bring it to the attention of the proper person.

A dose of a drug means the amount which will bring about the therapeutic action in an adult. A minimum dose is the smallest dose capable of producing a medicinal effect. Maximum dose is the greatest amount which may be given without probability of toxic effects. By a divided dose is meant a dose which is given at certain intervals of time, as for instance—

One grain of calomel may be ordered to be given in ¼ grain doses, one every half hour for 4 doses.

A dose of a drug is modified to a greater or lesser extent by certain factors.

Factors which modify dosage.

- *a.* Body weight: Stout people require larger doses.
- *b.* Age: Children and older people require less than the usual dose for an adult.

Young's rule for children from 2 to 12 years:

$$\frac{\text{Age in years}}{\text{Age} + 12} = \text{Fraction of adult dose.}$$

Children under one year:

$$\frac{\text{Age in months}}{150} = \text{Fraction of adult dose.}$$

With cathartics the dose for children approximates more nearly the adult dosage. With the derivatives of opium the dose is proportionately less.

c. Sex: Women usually require less than men.

d. Temperament: People of nervous temperament respond more readily to drugs and more quickly show evidences of overdosing. This also applies to races, those of the more stolid type requiring larger doses.

e. Idiosyncrasy: A person may be poisoned by a drug which ordinarily would be perfectly safe.

f. Tolerance and previous habits: The system may become accustomed to the action of a drug, so that to some extent it loses its effect and increased doses are necessary to obtain results. This applies especially to narcotics and sedatives.

g. Physical condition: In acute pain larger doses are required. Where there is a lowered resistance, the action may be produced by less than the usual dose. In impaired respiration, hypnotics are dangerous even in small doses. In diseases of eliminating organs a drug may produce cumulative poisoning.

Fractional dosage. It is sometimes necessary to give a fraction of a grain and tablets containing the particular fraction may not be on hand. They may contain more or less than the dose required.

Problem: To give a fraction of a grain from tablets of definite strength:

Example: Give gr. $\frac{1}{150}$ from tablets gr. $\frac{1}{100}$.

First find out the relation between the dose desired and the tablet on hand, following the rule for solutions.

$$\frac{\text{Desire } \frac{1}{150}}{\text{Have } \frac{1}{100}} \quad \frac{1}{150} \times \frac{100}{1} = \frac{2}{3}$$

which is the part of the tablet on hand to be used in order to get the desired dose.

We find that it is necessary to give $\frac{2}{3}$ of gr. $\frac{1}{100}$ in order to give gr. $\frac{1}{150}$. The gr. $\frac{1}{100}$ could be dissolved in 15 minims of water and $\frac{2}{3}$ of this would be 10 minims.

Example: Give 0.010 gram from 0.015 gram.

Proceed as before.

$$\frac{\text{Desire } 0.010}{\text{Have } 0.015} = \frac{2}{3}$$

Dissolve the 0.015 gram tablet in 3 c.c. of water and give the patient 2 c.c.

Example: From hypodermic tablets gr. 1/100 give gr. 1/60

$$\frac{1}{60} \times \frac{100}{1} = \frac{5}{3}$$

It would be necessary to use one tablet and 2/3 of another one. One could be dissolved in 15 minims. Use 10 minims and add the other tablet.

A better method is to find what 5/3 of two tablets is

$$\frac{5}{3} \div 2 = \frac{5}{3} \times \frac{1}{2} = \frac{5}{6}$$

$$\frac{5}{6} \times 30 \text{ m.} = 25 \text{ m.}$$

Dissolve the two tablets in 30 minims and give 25 minims to the patient.

10–20 minims is considered a good amount to give by hypodermic.

Example: Give strychnine sulphate gr. 1/20 from a solution dram I = gr. 1/30.

The problem is the same as before except that the tablets to be used have already been dissolved in a specified amount of water, that is, 1 dram in this instance.

$$\frac{1}{20} \times \frac{30}{1} = 1\tfrac{1}{2}$$

We find that if we had tablets gr. 1/30 we would give 1 1/2 tablets, but the tablets have already been dissolved for us and in each dram (60 minims) there is gr. 1/30. Therefore we would give one dram and a half.

$$\frac{1}{20} \times \frac{30}{1} \times 60 = \text{90 minims of the solution or one dram and a half.}$$

Example: Give morphine sulphate gr. 1/24 from a solution minims XXX = gr. 1/8.

$$\frac{1}{24} \times \frac{8}{1} \times 30 \text{ minims} = 10 \text{ minims of the solution.}$$

Example: From a solution of sodium bicarbonate dram I = gr. XX give grains XXV.

This means that the druggist has made up a certain amount of solution into every dram of which he has put gr. XX of sodium bicarbonate. As there are 60 minims in a dram there is one grain in each 3 minims. One would therefore give 75 minims or one dram and a quarter for gr. XXV.

Problem: To give grains from a solution, the strength of which is expressed in per cent:

Example: Give gr. II of camphorated oil from a 20% solution.

The solution on hand is 20% or 1–5. There is therefore one grain of camphor in each 5 minims. To give gr. II give 10 minims.

$$\frac{\text{Desire } 2}{\text{Have } \frac{1}{5}} \qquad 2 \times \frac{5}{1} = 10 \text{ minims.}$$

Example: From a 4% solution of cocaine give gr. 1/4.

The solution on hand has one grain in each 25 minims. To give gr. I give 6 minims.

$$\frac{\text{Desire } \frac{1}{4}}{\text{Have } \frac{1}{25}} \quad \frac{1}{4} \times \frac{25}{1} = 6\frac{1}{4} \text{ minims.}$$

The same formula which we used for the other problems may be used here.

DRILL:

1. Give strychnine sulphate gr. 1/20 from a 1% solution.

2. Give gr. II of caffeine from a 25% solution.

3. If you have one tablet gr. 1/60 and gr. 1/240 is desired for a child to be given by mouth every three hours, how would you obtain the dose? How many doses would be given from one tablet?

4. From morphine sulphate gr. 1/6 give gr. 1/4.

5. From pilocarpine gr. 1/3 give gr. 1/8.

6. From hyoscine hydrobromide gr. 1/150 give gr. 1/200

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remember Rule for making solution
pure drug
stock
percentage etc.

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means of destroying bacteria.

Remember common disinfectants
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CHAPTER XI

RULES, ORDER BOOK, ABBREVIATIONS

RULES FOR GIVING MEDICINES

1. The medicine closet must always be kept locked.

2. Never speak to anyone nor allow anyone to speak to you while giving medicines.

3. Always give exactly what is ordered and on time.

4. Read the label on the bottle three times.
   a. Before taking the bottle from the shelf.
   b. Before pouring the medicine from the bottle.
   c. After pouring the medicine from the bottle.

5. Always shake the bottle before pouring out the medicine.

6. When pouring medicine remove the stopper with the little finger, hold the bottle with the label towards the palm of the hand to avoid defacing the label. Before replacing the bottle, wipe the rim with gauze kept for the purpose.

7. When pouring medicine, hold the medicine glass with the thumb-nail placed on the required mark which indicates the quantity you require, and hold the mark on the level with your eye.

ractional dosages

8. Always recork bottles immediately after pouring medicine.

9. The person who has poured the medicine should always give it personally.

10. Never record a medicine as given until the patient has actually swallowed it.

11. Acids and medicines containing iron should be given through a glass tube and immediately after give the patient a drink of water.

12. Never mix nor give at the same time medicines which change color or form a precipitate (a solid which forms as the result of the combining of two liquids) when put together, as a chemical change has taken place.

13. Before giving a pill or powder to a delirious patient, an unconscious patient or a small child, always dissolve it in water.

14. Make a dose of medicine as palatable as possible. In diluting medicine, use water as cold as it is possible to obtain it. A disagreeable flavor may be made less noticeable by holding ice in the mouth before taking or by holding the nostrils while taking it. Castor oil and other oils (except croton oil) may be given in lemon juice, orange juice or coffee. Croton oil (ol. tiglii) may be given on sugar, or in a small piece of butter.

15. Powders may be placed on the tongue and swallowed with a drink of water.

16. Some cough medicines, such as Brown mixture, elixir terpin hydrate, should be given undiluted,

except in the case of a child, when they may have to be slightly diluted. Other medicines such as arsenic, iron, dilute acids, digitalis, potassium iodide, should be given well diluted.

17. Always have fresh drug. If pills are not readily dissolved, the drug is not fresh and should not be used. If a liquid contains sediment it should not be used.

18. Separate medicine glasses and medicine droppers should be used for oils and strong-smelling drugs.

19. Medicine should not be given with food unless so ordered.

20. Never use a drug from a box or bottle which has not a label.

Order book. Each hospital will have its own method for the writing of prescriptions. In many places a book is used for this purpose and in others the doctor writes his orders on a blank which is kept with the patient's clinical chart. A nurse should not accept a verbal order except in grave emergency and then it should be written as soon as possible. All orders should be dated and signed. In some hospitals the day orders are written in black ink and the night orders in red ink.

An order may be written for a drug which is to be increased daily, as for instance:

Potassium iodide, starting with minims 3 and increasing 1 minim daily until 10 minims is reached. This means that the dosage should be increased only

1 minim during the day, and requires that a chart should be kept like the following, so that it may be marked off each day.

John Smith.

Potassium iodide—Dec. 2nd, 1923.

		10	2	6	
Dec. 2	♍	III	III	III	(9)
Dec. 3	♍	III	III	IV	(10)
Dec. 4	♍	III	IV	IV	(11)
Dec. 5	♍	IV	IV	IV	(12)
Dec. 6	♍	IV	IV	V	(13)
Dec. 7	♍	IV	V	V	(14)

and so on until minims X for each dose is reached.

Prescriptions.

Every prescription consists of four parts:

Superscription: Name of patient, date, symbol, ℞.

Inscription: Names and amounts of drugs. The most important drug or base comes first.

Subscription: Directions to the druggist for compounding the prescription, and are usually in Latin.

Signature: This begins with S. or Sig. and are the directions to the patient, which the druggist is to write on the label.

To make a prescription complete it must have the doctor's name.

Example: For Mr. Robert Smith

Feb. 15, 1927.

℞ Phenac. gr. XL
Quinine gr. XXX
M. et Ft. in cap. No. XX
Sig. one capsule q. 4 h.
James Brown, M.D.

LATIN PHRASES AND ABBREVIATIONS

Abbreviation	*Derivation*	*Meaning*
aa	ana	(equal parts) of each
a.c	ante cibum	before meals
ad	ad	to, up to
ad lib	ad libitum	if desired
alt. hor	alterius horis	every other hour
alt. dieb	alterius diebus	every other day
alt. noct	alterius nocte	every other night
aq	aqua	water
aq. dist	aqua distillata	distilled water
b.i.d	bis in die	two times a day
b.i.n	bis in noctis	two times a night
C		centigrade
c	cum	with
c.c		cubic centimeter
Chart	charta	paper
comp	compositus	compound
C	congius	gallon
dil	dilutus	dilute
dr	drachma	dram
et		and
elix		elixir
ext	extractum	extract
F		Fahrenheit
fld	fluidus	fluid
Ft	fiat	make
gm	grammum	a gramme
gr	granum	a grain
gtt	gutta	a drop
h	hora	hour
inf. or infus	infusum	infusion

lb	libra	pound
liq		liquor
M	misce	mix
m	minimum	a minim
mist	mistura	mixture
No	numerus	number
noct	Nocte	in the night
O	octarius	pint
ol	Oleum	Oil
o.d	omne die	every day
o.h	omne hora	every hour
o.m	omne mane	every morning
o.n	omne nocte	every night
os	os	mouth
oz	uncia	ounce
p.c	post cibum	after meals
p.o	per os	by mouth
per	per	through or by
pil	pilula	pill
p.r.n	pro re nata	when required—occasionally
q.h	quaque hora	every hour
q.2h		every two hours
q.3h		every three hours
q.4h		every four hours
q.i.d	quatuor in die	four times a day
q.s	quantum sufficit	as much as is required
ne rep	ne repetatur	not to be repeated
℞	recipe	take
s	sine	without
s.c		subcutaneously
Sig. or S	signa	write on label
Sol		solution
s.o.s	si opus sit	one dose if necessary
spts	spiritus	spirits
sp. gr		specific gravity
ss	semissis	a half
stat	statim	immediately
syr	syrupus	syrup
t.i.d	ter in die	three times a day
t.i.n	ter in nocte	three times a night
tr. or tinc	tinctura	tincture
ung	unguentum	ointment
vin	vini	wine

CHAPTER XII

SOURCES AND CLASSIFICATION OF DRUGS

Sources.

Medicinal plants:

a. Crude drugs are obtained from the roots, leaves, flowers and seeds of medicinal plants.

b. Active principles are the chemical substances found in plants to which the medicinal action is due. They are more reliable than the crude drug.

Example:	
Medicinal plant	—white poppy
Part used	—capsule
Crude drug	—Opium
Active principle	—Morphine

Morphine gr. ¼ is more effective than gr. 1 of opium.

Animal origin:

a. Glands. When the glandular secretions of the body are deficient glands of animals may be used to supply the deficiency. *Example:* Thyroid Extract.

b. Ferments. When the cells of the body are not functioning properly and sufficient ferments (in the gastric, pancreatic and intestinal juices) are not supplied for the proper digestion of food, these ferments m y be supplied from the animal sources.

Minerals and other Elements. Compounds of the following elements, and also some of the free elements, are frequently used in medicine: Sodium, potassium, calcium, arsenic, magnesium, mercury, iron, silver, zinc, sulphur, phosphorus, carbon, iodine, chlorine, bromine, bismuth, nitrogen, hydrogen, radium.

Classification of drugs.

a. Crude drugs.

b. Active principles.

(1) Alkaloids: Bitter in taste. Act like a base as they react with acids to form salts. Most alkaloids are insoluble in water and they are used in the form of their salts which are soluble. Contain nitrogen. Precipitated by tannin and oxidized by a solution of potassium permanganate. Strong tea, which contains tannin, or potassium permanganate, 1–2000 are chemical antidotes for alkaloid poisoning. Names end in "ine." *Example:* Morphine, quinine, atropine, strychnine, codeine.

(2) Glucosides: Decomposed by heat, acids, bacteria. End product is glucose. Names end in "in." *Example:* Santonin.

(3) Saponins: Have some of the properties of soap. Irritate the tissues. Are not absorbed. *Example:* Quassia.

(4) Fixed oils: Decomposed by heat. *Example:* Castor oil.

(5) Volatile oils: Have a pleasant odor. Evaporate rapidly but are not decomposed by heat. *Example:* Oil of cloves.

(6) Tannins: Chemical composition is unknown but they act like acids. Form insoluble precipitates with alkaloids and proteins. Used as astringents.

(7) Resins: Obtained from the sap of trees. Soluble in alcohol but not in water. Solid resins. Resin of Podophyllum. Oleoresins—a resin with a volatile oil. Oleoresin of Aspidium. Balsams—resins with benzoic or cinnemic acid. *Example:* balsam of Peru.

Acids:

1. General characteristics of inorganic acids.
   - *a.* All contain hydrogen ions in solution. All contain a non metal and they may or may not contain oxygen.
   - *b.* Sour taste.
   - *c.* React with indicators. Turn blue litmus red. Turn red phenolphthalein colorless.
   - *d.* React with bases to form water and a salt.

  - *e.* React with carbonates to give carbon dioxide, water, and a salt. (This action is made use of in effervescing powders).
2. Organic acids: Obtained from plants and all contain carbon.
3. Administration and use:
  - *a.* Hydrochloric acid may be given to supply a deficiency in the gastric juice.
  - *b.* Acids withdraw water from the tissues by salt action.
  - *c.* Coagulate albumen.
  - *d.* Acids should always be well diluted and given through a glass tube.

Bases:

1. General characteristics of bases:
  - *a.* All bases have a metal and the hydroxyl radical (OH).
  - *b.* React with acids to form water and a salt.
  - *c.* Reaction with indicators. Turn red litmus blue. Turn colorless phenolphthalein red. Any substance which in solution gives a basic reaction with indicators is called an alkali.
2. Used to neutralize acids.

Alcohols: Alcohols are organic substances whose formulæ resemble the inorganic bases.

  - *a.* Grain alcohol—(Ethyl alcohol C_2H_5OH)
  - *b.* Wood alcohol—(Methyl alcohol CH_3OH)
  - *c.* Glycerine ($C_3H_5(OH)_3$)
  - *d.* Phenol (C_6H_5OH)

Salts:

There are as many salts as there are acids and metals. Many salts in solution undergo a double decomposition with one another so that the nurse should not give them together unless so ordered.

Salts frequently used:

Acetates
Benzoates
Carbonates
Citrates
Lactates
Salicylates
Tartrates
Borates
Bromides
Chlorides
Iodides
Nitrates
Phosphates
Sulphates

Coal tar products:

They are obtained from coal tar which is a product obtained by the destructive distillation of soft coal out of contact with the air. They are used mainly to reduce temperature and relieve pain and are very depressing.

Examples: Acetanilid, phenacetine.

Synthetic drugs:

These are organic substances which are made in the chemical laboratory. *Example:* Methyl salicylate.

Pharmaceutical preparations.

Solid and semisolid preparations: Extracts consist of the soluble parts of a medicinal plant reduced to semi-solid or solid condition by evaporating them, the soluble portion having been extracted from the plant by alcohol or water. An extract has four or five times the strength of the crude drug.

Powders are finely divided solid drugs.

Fluid preparations: Fluid extract is a concentrated alcoholic extract 100% in strength. One minim of a fluid extract is equivalent to grain I of the drug.

Tinctures are liquid preparations of non-volatile drugs made by extracting the drug with alcohol. Tinctures of potent drugs are 10% while those of non-potent drugs are usually 20%.

Wines are liquid preparations with wine used as the solvent.

Infusions are liquid preparations made by pouring boiling water on a crude drug and allowing it to stand for half an hour, after which the liquid is strained. Infusions do not keep well.

Decoctions are made by boiling a drug in water for 15 minutes. Unless otherwise specified, proportions are 50 grams of drug to 950 c.c. of water.

Solutions: In water: Water has no medicinal action and is cheap. Disadvantage: Aqueous solutions do not keep well.

Waters are volatile substances in solution. *Examples:* Cinnamon water. Ammonia water.

Solutions are non-volatile substances, such as salts in solution. *Example:* Fowler's solution.

Mucilages are aqueous solutions of a gummy substance. *Example:* Mucilage of acacia.

Syrups are solutions of drug and sugar in water, the sugar acting as a preservative and vehicle for the drug. *Example:* Syrup of hydriodic acid.

Solutions: In alcohol. Alcohol acts as a preservative but also has a medicinal action of its own.

Spirits are alcoholic solutions of a volatile drug. *Example:* Spirit of camphor.

Elixirs are aromatic alcoholic solutions, sweetened and flavored. *Examples:* Elixir of iron, quinine and strychnine.

Other solvents:

Vinegars are preparations made with vinegar or dilute acetic acid. *Example:* Aromatic vinegar.

Glycerites are solutions of a drug in glycerine. They keep well and are less irritating than alcoholic solutions.

Emulsions are solutions in which an oil or resin is suspended in water, usually by some gummy material.

Mixtures are suspensions of insoluble substances in other fluids.

Liniments are liquid preparations for external use, containing an anodyne or counter irritant in oil, alcohol or a soapy solvent.

Oleorism is a preparation containing the resins and oils of a crude drug.

Dosage forms for internal use. Drugs are divided into definite doses and may be used in the following forms, which serve also to disguise the taste of the substances.

Effervescing powders are mixtures of a drug, an acid and a carbonate. The action of the acid on the carbonate produces carbonic acid, which immediately breaks down into water and carbon dioxide.

Pills: A pill is a mixture of a drug and some adhesive substance. They may be coated.

Capsules are small containers, usually made with gelatine.

Cachets: Thin sheets of dry flour paste in which the drug is placed. They are immersed in water and swallowed.

Lozenges are drugs which are mixed with a demulcent.

Confections are drugs mixed with honey and sugar to disguise the taste.

Ampules are glass capsules and are used for sterile preparations.

Triturates are dry mixtures of a drug and sugar of milk. (10% of the active medicine to 90% of sugar of milk.) The purpose of this mixture is to prepare in usable form a drug the dose of which is very small. Tablet Triturate is the mixture made into very soluble tablets.

Compressed tablets are medicinal substances or mixtures of medicinal substances compressed to the form of a disc.

Suppositories are preparations of a drug and a firm base, usually cocoa butter, made into suitable shape for insertion in the rectum, urethra or vagina. Suppositories must be kept in a cool place. Cocoa butter melts at body temperature.

Preparations for external use.

Dusting Powders are fine, non irritant powders used for protection and to absorb secretions.

Ointments are mixtures of a drug and a fatty base, usually petrolatum or benzoinated lard. When they are applied for systemic effect they must be well rubbed in.

Cerates resemble an ointment but the base is made more firm by adding wax or paraffine.

Plasters are medicinal substances spread on suitable material for external application.

Lamellæ are thin gelatin disks, softened with glycerin and contain drugs acting on the pupil of the eye. They are placed under the eyelids.

Chartæ are papers that have been impregnated with a drug, such as mustard paper.

Deliquescent drugs are those which when exposed to the air absorb enough moisture to liquefy them. They must be kept in tightly stoppered bottles. *Example:* calcium chloride.

Desiccated drugs are preparations from which water has been extracted. *Example:* Desiccated thyroid.

Exsiccated drugs are preparations from which the water of crystallization has been removed. *Example:* Sodium arsenate, exsiccated.

CHAPTER XIII

THE FIRST AID TREATMENT FOR POISONING

Toxicology is the study of the detection and action of poisons and their treatment.

Action of Poisons:

1. Irritants.

(*a*) Corrosives cause severe inflammation followed by the destruction of tissue at their points of contact.

Examples: Mineral acids, strong alkalies, metallic salts, phenol, oxalic acid.

Characteristic symptoms of poisoning:

- Vomiting—
  - Vomitus may be blood-streaked or contain shreds of mucous membrane.
- Burns of mouth, throat, esophagus and stomach. Difficulty in swallowing.
- Oedema of glottis.
- Diarrhea.
- Collapse.

(*b*) Simple Irritants cause irritation of tissue at their points of contact.

Examples: Croton Oil—Formaldehyde.
Characteristic symptoms of poisoning:
Gastro-intestinal irritation—vomiting; abdominal pain, diarrhea.

2. Non-Corrosive Poisons.

(*a*) Convulsants.
Example: Strychnine.
Characteristic symptoms of poisoning;
Twitching—diarrhea—convulsions.

(*b*) Somnifacients.
Example: Opium and its derivatives.
Characteristic symptoms: Stupor and coma. Pin point pupils slow pulse and respiration.

(*c*) Cardiac poisons.
Examples: Digitalis—aconite.
Characteristic symptoms: Vomiting—cardiac irregularity—collapse.

(*d*) Alter the haemoglobin of the blood.
Example: Illuminating gas poisoning.
Characteristic symptoms: Nausea, vomiting, malaise, coma.

(See page 118 for symptoms of poisoning by individual drugs.)

Antidotes are agents used to counteract a poison.

Types of antidotes:

Physical antidotes are substances which envelop the poison and help to prevent its absorption. They also protect the mucus membrane of the gastro-intestinal tract.

Physical antidotes: Mashed potatoes, gruel, milk, white of egg, olive oil.

Chemical antidotes are substances which react chemically with the poison, changing its nature. The result of the chemical change must be non-toxic and is later removed from the stomach by lavage. Chemical antidotes are only effective before the poison is absorbed.

Physiological antidotes produce the opposite systemic effect from the poison. They are never given by the nurse except on the order of the physician. Example, caffeine for opium poisoning.

General Principles for First Aid Treatment.

1. Have a physician summoned.
2. Keep the patient warm.
3. Give an emetic or use lavage to remove as much of the poison as possible from the stomach, except in the case of corrosive poisonings and strychnine poisoning, unless ordered by the physician. Save all vomited material for the inspection of the physician.

(Lavage can be accomplished without the use of a stomach tube by giving 8 to 16 ounces of fluid.)

Emetics are:

Sodium chloride—1 ounce.
Warm water—1 pint.
Mustard—1 ounce.
Warm water—1 pint.
Zinc sulphate—grains XV–XXX in glass of water.
Copper Sulphate—8 grains in glass of water.

4. Give the chemical antidote for the poison if there is one available.
5. If there is no chemical antidote available give a physical antidote, especially in the case of corrosives.

Treatment for Common Poisons.

Acids.

Hydrochloric (Muriatic) — Nitric — Oxalic — Sulphuric.

1. Give a weak alkali to neutralize the acid.
   Glass of lime water—magnesium oxide, 4 drams in a glass of water—chalk and water —soap and water—½ glass of milk of magnesia.
2. Give a physical antidote.
   Milk and egg—gruel—olive oil.

Alkalies.

Potassium Hydroxide — Sodium Hydroxide — Ammonia Water.

1. Give an organic acid to neutralize the alkali.
   Vinegar, 1 dram in a glass of water—Tartaric acid, gr. XXX, or Citric acid, gr. XXX, in glass of water—Lemonade.
2. Give a physical antidote.
   Milk—white of egg—olive oil.

Salts of Mercury—Lead—Silver—Copper.

1. Give an emetic or wash the stomach.
2. Give the chemical antidote. Metallic salts are precipitated by protein.
   White of 2–4 eggs for any of the group.

For lead salts—
  Magnesium sulphate, 4 drams in a glass of water.
For silver nitrate—
  Sodium chloride, 2 drams in a glass of water; followed by emetic to remove the silver chloride which has been formed.

Alkaloids.

Atropine—Morphine—Strychnine.

1. Give an emetic or use chemical antidote as lavage except in the case of strychnine.
2. Give a chemical antidote. Alkaloids are oxidized by:
    - (*a*) Potassium permanganate—1-2000.
    - (*b*) Hydrogen peroxide—¼ glass diluted with an equal amount of water.

    They are precipitated by tannin—give strong tea freely.
3. Apply external heat and give hot coffee in morphine and atropine poisoning.

    In morphine poisoning apply cold compresses to the face, keep the patient roused.

    In strychnine poisoning keep the patient very quiet.
4. Give artificial respiration if necessary.

Coal Tar Analgesics.

Antipyrine—Acetanilid—Phenacetine.

1. Give hot coffee.
2. Apply heat externally.
3. Give artificial respiration if necessary.

Alcohol.

1. Give an emetic or lavage.
2. Give hot coffee.
3. Apply external heat
4. Artificial respiration if necessary.

Arsenic.

1. Give an emetic or lavage.
2. Give the chemical antidote—Ferric hydroxide with magnesia.
3. Repeat the emetic.
4. Give a physical antidote: Milk—white of egg —olive oil.

Cyanides.

or Hydrocyanic Acid. (Death occurs almost immediately.)

1. Remove the patient to the open air.
2. Give an emetic.
3. Apply cold water to head and spine.
4. Aromatic spirit of ammonia to nostrils.
5. Give artificial respiration.

Formaldehyde. Solution.

1. Give an emetic or lavage.
2. Give the chemical antidote: Very dilute ammonia water—solution of ammonium chloride.
3. Give a physical antidote: Milk—white of egg —gruel.

Iodine.

1. Give an emetic or lavage.

2. Give chemical antidote: Flour and water or starch and water copiously.
3. Give physical antidote: Milk—white of egg.

Phenol.

1. Give whiskey to dilute the phenol or lavage.
2. Give a chemical antidote:
   Magnesium sulphate, drams 4, to pint of warm water.
   Sodium sulphate, drams 4.
3. Give physical antidote: Milk—white of egg—olive oil.

Phosphorus.

1. Give an emetic.
2. Give chemical antidote: Potassium permanganate, 1-2000.
   No oil.

For local burns apply alcohol.

Gas Poisoning—carbon monoxide, illuminating gas, sewer gas.

1. Give artificial respiration.

APPENDIX

OFFICIAL AND COMMON NAMES OF DRUGS IN FREQUENT USE

Alcohol	Spiritus vini recti
Adrenalin	Epinephrine
Aristol powder	Thymolis iodidum
Aspirin	Acetyl salicylic acid
Basham's mixture	Liquor ferri et ammonii acetatis
Brandy	Spiritus vini galli
Blue mass	Massa hydrargyi
Calomel	Hydrargyri chloridum mite
Castor oil	Oleum ricini
Cascara sagrada	Rhamnus purshiana
Cod Liver Oil	Oleum morrhuæ
Croton oil	Oleum tiglii
Cream of tartar	Potassii bitartras
Dover's powder	Pulv. opii et ipecacuanhae
Epsom salt	Magnesium sulphate
Fowler's solution	Liq. potassii arsenitis
Hoffman's anodyne	Spiritus aetheris compositus
K. I.	Potassium iodide
Laudanum	Tr. opii
Lime water	Aqua calcis
Magendie's solution	Solution of morphine 1–30
Mustard	Sinapis
Oil of wintergreen	Oleum gaultheriae
Paregoric	Tr. opii camphorata
Rochelle salt	Potassii et sodii tartras
Silver nitrate	Argenti nitras
Soap liniment	Linimentum saponis
Soda	Sodii bicarbonas
Sweet spirit of nitre	Spiritus aetheris nitrosi
Tincture of iodine	Tinctura iodi

Triple elixir	Elixir quinine, iron and strychnine
Urotropine	Hexamythelenamine
Whiskey	Spiritus frumenti

Table for Making Solutions

		To make 1 pint or 500 c.c. Quantity of drug to be used	
1/10% .1%	1-1000	7.6 grains	0.5 gram
1/5% .2%	1-500	15.3 grains	1 gram
1/4% .25%	1-400	19 grains	1.25 grams
1/2% .5%	1-200	38 grains	2.5 grams
9/10% .9%	1-111 + (9-1000)	69.1 grains	4.5 grams
1%	1-100	76 grains	5 grams
2%	1-50	153 grains	10 grams
3%	1-33	3 drams, 50 grains	15 grams
4%	1-25	5 drams, 7 grains	20 grams
5%	1-20	6 drams, 24 grains	25 grams
6%	1-16	7 drams, 40 grains	30 grams
10%	1-10	1 oz., 4 dr., 48 gr.	50 grams
20%	1-5	3 oz., 1 dr., 36 gr.	100 grams
25%	1-4	4 ounces	125 grams
50%	1-2	8 ounces	250 grams
		Water to 1 pint	Water to 500 c.c.

For drugs which are fluids and 100% in strength substitute minims for grains, and fluid drams and fluid ounces for drams and ounces. In the metric measure similarly substitute c.c. for grams.

Giving Grains from Solutions

In	Grains I in each
1%.....	100 minims
2%.....	50 minims
3%.....	33 minims
4%.....	25 minims
5%.....	20 minims
10%.....	10 minims
20%.....	5 minims
25%.....	4 minims

Table Showing the Number of Units of Water to be Added to One Unit of Stock Solution

Strength of Stock Solution	Desired Strength				
	1–5000	1–1000	1–500	1–200	1–100
1%........	49	9	4	1	
2%........	99	19	9	3	1
3%........	149	29	14	5	2
4%........	199	39	19	7	3
5%........	249	49	24	9	4
6%........	299	59	29	11	5
10%........	499	99	49	19	9
20%........	999	149	99	39	19
25%........	1249	249	124	49	24

Table for Making Weaker Solutions from Stock Solutions. To Make 1 *Pint or* 500 *c.c.*

Strength of Stock Solution	Desired Strength				
	1–5000	1–1000	1–500	1–200	1–100
1% 1–100....	153 minims 10 c.c.	1 oz. 4 dr. 48 m. 50 c.c.	3 oz. 1 dr. 36 m. 100 c.c.	8 ounces 250 c.c.	
2% 1–50.....	76 minims 5 c.c.	6 dr. 24 m. 25 c.c.	1 oz. 4 dr. 48 m. 50 c.c.	4 ounces 125 c.c.	8 ounces 250 c.c.
3% 1–33.....	51 minims 3 c.c.	4 dr. 16 m. 16 c.c.	1 oz. 32 m. 33 c.c.	2 oz. 5 dr. 20 m. 84 c. c.	5 oz. 2 dr. 40 m. 166 c.c.
4% 1–25.....	38 minims 2 c.c.	3 dr. 12 m. 12 c.c.	6 dr. 24 m. 25 c.c.	2 ounces 62 c.c.	4 ounces 125 c.c.

5%	1–20.....	30 minims 2 c.c.	2 dr. 33 m. 10 c.c.	5 dr. 7 m. 20 c.c.	1 oz. 4 dr. 48 m. 50 c.c.	3 oz. 1 dr. 36 m. 100 c.c.
6%	1–16.....	25 minims 1.6 c.c.	2 dr. 8 m. 8 c.c.	4 dr. 16 m. 16 c.c.	1 oz. 2 dr. 40 m. 42 c.c.	2 oz. 5 dr. 20 m. 84 c.c.
10%	1–10.....	15 minims 1 c.c.	1 dr. 16 m. 5 c.c.	2 dr. 33 m. 10 c.c.	6 dr. 24 m. 25 c.c.	1 oz. 4 dr. 48 m. 50 c.c.
20%	1–5......	8 minims .5 c.c.	38 minims 2.5 c.c.	1 dr. 16 m. 5 c.c.	3 dr. 12 m. 12 c.c.	6 dr. 24 m. 25 c.c.
25%	1–4......	6 minims .4 c.c.	31 minims 2 c.c.	1 dr. 2 m. 4 c.c.	2 dr. 33 m. 10 c.c.	5 dr. 7 m. 20 c.c.

Water to 1 *Pint or Water to* 500 *c.c.*

Under desired strength will be found the amount of stock solution necessary to use to make a pint or 500 c.c. of weaker solution from the given stock solution.

Drugs in Frequent Use

DRUG	AVERAGE DOSE		PRINCIPAL EFFECTS	SYMPTOMS OF OVERDOSING*
	Apothecaries	Metric		
Acetanilid (Antifebrin)	gr. III	0.20 gm.	Relieves neuralgia, reduces the temperature, and in large doses acts as a cardiac depressant.	Cyanosis, abnormal fall of temperature, excessive perspiration and cold extremities.
Acetphenetidin (Phenacetin)	gr. V	0.30 gm.	Relieves pain, antipyretic and cardiac depressant.	Profuse perspiration, slow, weak pulse, cyanosis.
Acetylsalicylic Acid (Aspirin)	gr. V–XV	0.3–1 gm.	Antipyretic, specific in rheumatism and analgesic for muscular pain.	Ringing in the ears, nausea, profuse perspiration.
Aconite Tincture	m. III	0.2 c.c.	Slows the pulse and lowers blood pressure. Applied locally it acts on the sensory nerve endings and depresses them. Antipyretic and diaphoretic.	Tingling and numbness of tongue and mouth, followed by numbness which passes over entire body. Nausea and vomiting Pulse irregular and weak. Cold, moist skin. Muscular weakness.
Adrenalin (See Epinephrin)				
Ammonium Acetate Solution	dr. IV	15 c.c.	Increases perspiration and flow of urine.	

*No treatment is given here as the condition usually calls for a physiological antidote which is prescribed by the physician. On observing these symptoms the nurse should stop giving the drug, notify the physician and give such nursing care as the symptoms warrant. The first aid treatment for the common poisonings is given on page 106.

Chloride	gr. V–XV	0.30–1 gm.	Expectorant.	Acute Ammonia Poisoning.
Carbonate	gr. IV	0.25 gm.	Heart stimulant and expectorant.	Severe burning pain in mouth, throat and stomach. Nausea, vomiting, body cold. Profuse perspiration.
Aromatic Spirit	m. 15–60	1–5 c.c.	Stimulant, relieves nausea and aids in expulsion of gas in the stomach.	
	(Dilute	with water)		
Amyl Nitrite	m. III	0.2 c.c.	Dilates the blood vessels, relaxes muscles of bronchi and reduces blood pressure.	Face and neck flushed, faintness, throbbing headache, dizziness.
	(By in	halation)		
Antifebrin (See Acetanilid)				
Antipyrene	gr. V	0.3 gm.	Relieves neuralgic pains, reduces temperature and causes profuse perspiration.	As in acetanilid.
Apomorphine Hydrochloride	gr. $\frac{1}{10}$	5 mg.	Emetic.	
	(Used subc	utaneously)		
Arsenic			Increases the metabolism of the body and the number of red blood corpuscles.	*Acute*—Burning and choking sensation in throat. Pain in stomach. Nausea and vomiting. Suppression of urine. Profuse watery stools. *Cumulative* — Puffiness under the eyes, loss of appetite, colicky pains in stomach, diarrhea with stools containing small pieces of mucous membrane, rash on face or abdomen.
Arsenous and Mercuric Iodide (Donovan's Solution)	m. Iss.	0.1 c.c.		
Trioxide	gr. $\frac{1}{60}$–$\frac{1}{30}$	0.001–0.002 gm.		
Potassium arsenite (Fowler's Solution)	m. III	0.2 c.c.		
Sodium Arsanilate	gr. $\frac{1}{3}$	0.02 gm.	Arsenic is a specific for syphilis. See Salvarsan.	
Sodium Arsenate	gr. $\frac{1}{10}$	5 mg.		
Sodium Cacodylate	gr. ½	0.03 gm.		

Drugs in Frequent Use

DRUG	AVERAGE DOSE		PRINCIPAL EFFECTS	SYMPTOMS OF OVERDOSING
	Apothecaries	Metric		
Asafoetida			Checks the formation and aids in the expulsion of gas. Has a psychic effect in quieting hysterical patients, the effect probably being due to its odor and unpleasant taste.	Excessive secretion of mucus. Irritation of mucous membrane.
Pills	gr. IV	0.25 gm.		
Tincture	m. XV	1 c.c.		
Emulsion (Milk)	dr. IV	15 c.c.		
Aspidium Oleoresin	gr. XXX	2 gm.	Given in divided doses. Destroys tapeworms.	Nausea and vomiting, diarrhea, muscular spasms in the extremities, coma, collapse.
Aspirin (See Acetylsalicylic Acid)				
Atophan (Cinchophen) (Phenylcinchoninic Acid)	gr. V	0.3 gm.	Relieves pains of joints in acute gout. Increases the amount of urine.	
Atropine (See Belladonna)				
Barbital (See Veronal)				

Basham's Mixture (See Iron)				
Belladonna				
Atropine Sulphate	gr. 1/160	0.4 mg.	Respiratory stimulant, cardiac stimulant, checks secretions and relaxes the involuntary muscles. Dilates the pupil of the eye.	Excessive thirst. Talkativeness. Flushed skin. Marked dilatation of pupils.
Extract	gr. 1/6	0.01 gm.		
Tincture	m. VIII	0.5 c.c.		
Plaster	Used locally	to relieve pain		
Benzoin				
Compound Tincture	m. XXX (dr. I to a water for	2 c.c. pint of boiling inhalation)	Expectorant.	
Benzyl Benzoate	m. XXX	2 c.c.	Relieves the spasm of involuntary muscles.	
Bismuth				
Subcarbonate	gr. VIIss.	0.5 gm.	Astringent and protective action in the stomach and intestines.	If the subnitrate is used there may be symptoms of nitrite poisoning. See amyl nitrite.
Subgallate	gr. IV	0.25 gm.		
Subnitrate	gr. XV	1 gm.		
Blaud's Pill (See Iron)				
Blue Mass (See Mercury)				

Drugs in Frequent Use

DRUG	AVERAGE DOSE		PRINCIPAL EFFECTS	SYMPTOMS OF OVERDOSING
	Apothecaries	Metric		
Bromides			Lessen nervous irritability, allay pain in neuralgia, check vomiting, if of central origin, quiet reflexes, prevent epileptic convulsions.	*Acute* — Depression, apathy, stupor, slow respiration. *Cumulative*—Dull, stupid, expressionless face, sluggish mentally and physically, fetid breath, skin eruption.
Ammonium	gr. XV	1 gm.		
Sodium	gr. XV	1 gm.		
Potassium	gr. XV	1 gm.		
Strontium	gr. XV	1 gm.		
Brown Mixture				
(Paregoric, Antimony, Potassium Tartrate, Licorice, Spirit of Nitrous Ether)	dr. I	4 c.c.	Lessens coughing.	
Caffeine				
Citrate	gr. II	0.1 gm.	Stimulates cerebral centers, diminishes muscular fatigue, stimulates cells of kidney.	Headache, restlessness, confusion, noises in ears, rapid, weak pulse, shallow rapid respirations, profuse flow of urine.
Citrate, Effervescent	dr. I	4 gm.		
Sodium Benzoate	gr. II	0.1 gm.		
Calcium			Increases coagulability of the blood. Nerve and muscle sedative.	
Chloride	gr. VII*ss.*	0.5 gm.		
Hypophosphite	gr. VII*ss.*	0.5 gm.		
Lactate	gr. VII*ss.*	0.5 gm.		

Calomel (See Mercury)				
Camphor	gr. II	0.1 gm.	Stimulates the central nervous system. Cardiac stimulant.	Burning sensation in stomach, dizziness, weak extremities, cold, moist skin.
Camphoric Acid	gr. XV	1.0 gm.	Checks excessive perspiration.	
Cannabis indica	……	……	Used in cough mixtures.	*Cumulative* — Hallucinations, dullness of intellect.
Extract	gr. $\frac{1}{5}$	0.01 gm.	Produces a delirium, followed by sleep. Relieves pain.	
Tincture	m. VIII	0.5 c.c.		
Capsicum, Tincture	m. VII*ss.*	0.5 c.c.	Stomachic and carminative.	Vomiting, diarrhea, severe pain in stomach, painful micturition.
Cardamom, Tincture	dr. I	4 c.c.	Stomachic and carminative.	
Cascara (See Rhamnus)				
Castor Oil (See Ricini Ol.)				
Chaulmoogra Oil	m. XV	1 c.c.	Used in the treatment of leprosy.	
Ethyl Chaulmoograte	m. XV	1 c.c.		
Chloral Hydrate	gr. XV Given in	1 gm. cracked ice	Produces sleep when insomnia is due to nervous excitement. Relieves pain in "tic douleureux." Relaxes muscular spasm.	*Acute*—Slow, weak, irregular pulse, slow, shallow breathing, contracted pupils, coma. *Cumulative* — Disturbance of gastro-intestinal tract, patient is nervous, has insomnia.
Chloroform	……	……	General anesthetic.	*Acute*—Slow, weak pulse, shallow, slow respirations, dilated pupils, pale skin.
Spirit of Chloroform	m. XXX	2 c.c.	Relieves colicky pain.	

Drugs in Frequent Use

Drug	Average Dose		Principal Effects	Symptoms of Overdosing
	Apothecaries	Metric		
				Delayed — Nausea, vomiting, jaundice, scanty urine with albumen present, collapse.
Cinchona, Tincture........	dr. I	4 c.c.	Stomachic.	See Quinine.
Cinchophen (See Atophan)				
Cocaine..................	....	....	Local anesthetic, constricts peripheral blood vessels. Acts as astringent on mucous membranes. Dilates the pupils of the eye.	*Acute*—Talkativeness, apprehension, rapid pulse, faintness, convulsions. *Cumulative*—Nervous irritability, digestive disturbance, loss of moral sense.
Hydrochloride..........	gr. ½	0.03 gm.		
	Solution 2–10%			
Codeine (Methyl Morphine)	gr. ½	0.03 gm.	Relieves pain, lessens coughing. Produces a light sleep.	See Opium.
Phosphate..............	gr. ½	0.03 gm.		
Sulphate...............	gr. ½	0.03 gm.		
Cod Liver Oil (See Morrhuae Oleum)				

Compound Cathartic (Colycynth, Calomel, Gamboge, Jalap)	1–2 pills			
Corpus Luteum	gr. II	0.1 gm.	Relieves nervous symptoms during menopause, increases menstrual function.	
Creosote	m. III	0.2 c.c.	Expectorant and intestinal antiseptic.	As in carbolic acid poisoning. See page 48.
Croton Oil (See Tiglii, Ol.)				
Diacetyl Morphine (See Heroin)				
Digitalis	gr. I	0.065 gm.	Stimulates the heart muscle, causing a slow, strong pulse, and better circulation. Acts as a diuretic because of improved circulation of kidneys.	Pulse below 60, anorexia, nausea, vomiting, diarrhea, headache.
Infusion	dr. II	8 c.c.		
Tincture	m. XV	1 c.c.		
Digalen	m. XV	1 c.c.		
Digipuratum	gr. 1½	0.1 gm.		
Digifolin	m. XV	1 c.c.		
Dionin (Ethyl morphine)	gr. ¼	0.015 gm.	Substitute for morphine. Does not contract the pupil.	
Diuretin (See Theobromine)				
Donovan's Solution (See Arsenic)				
Dover's Powder (See Opium)				
Epinephrine (Adrenalin) Chloride 1–1000	m. V–X Intraven muscularly mically. used in 1–10,000	0.3–0.6 c.c. ously, intra- or hypoder- Locally it is 1–1000 to solutions.	Locally it constricts the peripheral blood vessels. Heart beats slower and stronger. Increases the contractions of the uterine muscles and relaxes the muscles of the stomach and intestines. Increases the saliva and mucus.	Slow, irregular pulse, blanched skin and mucous membrane, dilated pupils, collapse.

Drugs in Frequent Use

DRUG	AVERAGE DOSE		PRINCIPAL EFFECTS	SYMPTOMS OF OVERDOSING
	Apothecaries	Metric		
Epsom Salt (See Magnesium Sulphate)				
Ethyl chloride			Local anesthetic.	
Ethyl Morphine (See Dionin)				
Ergot	gr. XXX	2 gm.	Contracts the involuntary muscles, especially those of the uterus. Prevents and checks uterine hemorrhage.	*In abortion*—Severe abdominal pain, vomiting, diarrhea, uterine bleeding, collapse.
Fluid Extract	m. XXX	2 c.c.		
Eserine (See Physostigmine)				
Ether	m. XV	1 c.c.	General anesthetic. Administered internally as a heart stimulant. Carminative.	Slow, shallow breathing, cyanosis, weak pulse, pupils dilated and do not react to light.
Spirit	dr. I (on ice)	4 c.c.		
Compound Spirits	dr. I (on sugar)	4 c.c.		
(Hoffman's Anodyne)				

Spirit of Nitrous Ether (Sweet Spirit of Niter)	m. XXX	2 c.c.	Increases perspiration thereby reducing fever. Diuretic.	See amyl nitrite
Eucalyptus, Oil	m. VIII	0.5 c.c.	Expectorant and respiratory antiseptic. Intestinal antiseptic.	
Fel Bovis (Ox Gall)	gr. VIIss.	0.5 gm.	Intestinal antiseptic and is reputed to stimulate the secretion of bile. Laxative.	
Ferrous Carbonate et al. (See Iron)				
Fowler's Solution (See Arsenic)				
Gaultheria, Oil of (Oil of Wintergreen)	m. XV	1 c.c.	When taken internally has the same action as the salicylates. Applied locally for the relief of pain.	As in salicylism.
Gelsemium			Paralyzes nerve endings and lessens muscular twitchings.	Motor paralysis, shown by staggering gait, loss of sensation in skin, pupils dilated, pulse slow and weak.
Fluidextract	m. II	0.1 c.c.		
Tincture	m. V	0.3 c.c.		
Gentian				
Compound Tincture	dr. I	4 c.c.	Stimulates the appetite and the secretion of gastric juice.	
Extract	gr. IV	0.25 gm.		
Ginger (Zingiber)	gr. XV	1 gm.	Stomachic and carminative.	
Tincture	m. XXX	2 c.c.		

Drugs in Frequent Use

DRUG	AVERAGE DOSE		PRINCIPAL EFFECTS	SYMPTOMS OF OVERDOSING
	Apothecaries	Metric		
Glauber's Salt (See Sodium Sulphate)				
Glyceryl Trinitrate (Nitroglycerin)				
Spirit	m. I	0.065 c.c.	Has the same effect as amyl nitrite but acts more slowly.	See amyl nitrite.
Glycyrrhiza (Licorice)				
Fluidextract	m. XXX	2 c.c.	Demulcent.	
Compound Powder	gr. LX	4 gm.	Laxative.	
Compound Mixture (See Brown Mixture)				
Guiacol	m. VIII	0.5 c.c.	Intestinal antiseptic and expectorant.	As in phenol poisoning.
Carbonate	gr. XV	1 gm.		
Hedonal	gr. XXX	2 gm.	Produces sleep in about ½ hr. after administration.	
Heroin			Resembles morphine but it affects the brain less and depresses the respiration more. Used to relieve coughing.	As in opium poisoning.
(Diacetyl Morphine) Hydrochloride	gr. 1/20	3 mg.		

Hexamethylenamine...... (Urotropine)	gr. V......	0.3 gm.	In an acid medium it frees formaldehyde and acts as a urinary antiseptic.	Blood in urine, painful micturition.
Hoffman's Anodyne (See Ether, Compound Spirits of)				
Homatropine............ Hydrobromide.........	gr. 1/25 Local	0.5 mg. ½–2%	Action as in atropine.	See Atropine.
Hydrargyrum compounds (See Mercury)				
Hydrastis				
Fluid extract.......... Hydrastinine hydrochloride	m. XXX gr. ½	2 c.c. 0.03 gm.	Increases the appetite and aids digestion. Raises blood pressure. Checks uterine bleeding.	Slow, weak pulse, difficult breathing due to depression of respiratory center; convulsions.
Hydrochloric Acid........ (Dilute 10%)	m. XV	1 c.c.	Supplies deficiency of hydrochloric acid in stomach.	Acute acid poisoning: Pain in mouth, throat and stomach; intense thirst; difficulty in speaking and swallowing; vomiting; collapse. Skin and mucous membrane would be a grayish white.
Hyoscine............... (Scopolamine)	....	....	Resembles atropine in its influence on the nerve endings, but has a sedative action on the brain. Produces sleep.	As with Atropine.
Hydrobromide.........	gr. 1/25	0.5 mg.		

Drugs in Frequent Use

Drug	Average Dose		Principal Effects	Symptoms of Overdosing
	Apothecaries	Metric		
Hyoscyamus Tincture	m. X–XXX	0.6 to 2 c.c.	Effects like those of Tincture of Belladonna.	
Hypophysis (See Pituitrin)				
Insulin (Iletin)	Number of units given depends on percentage of sugar in the blood.		Reduces the sugar in the blood and is used in the treatment of diabetes.	Weakness, profuse sweating, dullness of vision, drowsiness, coma.
Iodine Tincture	m. 1½	0.1 c.c.	Rarely used internally. Used locally as antiseptic and counter-irritant.	See Page 64.
Compound Solution of (Lugol's Solution)	m. III–XII	0.2–0.8 c.c.	Used in the treatment and prevention of goitre.	
Iodides			Specific in third stage of syphilis, expectorant, aids in the absorption of fluid in pleurisy with effusion, increases the absorption of newly formed connective tissue cells.	Coryza, pain in region of frontal sinus, papular eruption of skin, salivation, tremor, nervous irritability.
Potassium	gr. V–XXX	0.3–2 gm.		
Sodium	gr. VII*ss.*	0.5 gm.		
	(Given in milk)			
Ipecacuanhae (Ipecac)	gr. I, XV	0.065, 1 gm.	Acts as an emetic in large doses and in small doses as an expectorant, and stomachic. Specific in amoebic dysentery.	Profuse diarrhea, and secretion of mucus and saliva, accompanied by symptoms of collapse.
Fluid extract	m. I, XV	0.065, 1 c.c.		
Syrup	m.IV, dr.IV	0.25, 15 c.c.		
Wine	m. X, dr. IV	0.6, 16 c.c.		
	Small dose as expectorant Large dose as emetic			

Iron (Ferrum)				
Ferrous Carbonate			Iron increases the haemoglobin and the number of red blood corpuscles. Locally iron acts as an astringent.	Frontal headache, nausea and vomiting, constipation.
Mass of Ferrous Carbonate (Vallet's Mass)	gr. IV	0.25 gm.		
Ferrous Carbonate Pills (Blaud's Pills)	2 pills			
Ferric Chloride Tinct.	m. VIII	0.5 c.c.	Liquid preparations of iron should be well diluted and given through a glass tube.	
Ferrous Iodide Syrup	m. XV	1 c.c.		
Ferric Phosphate	gr. IV	0.25 gm.		
Iron and Ammonium Acetate (Basham's Mixture)	dr. II	8 c.c.		
Iron and Ammonium Citrate	gr. IV	0.25 gm.		
Iron, Quinine, Strychnine Elixir	dr. I	4 c.c.		
Reduced Iron	gr. I	0.065 gm.		
Jaborandi (See Physostigmine)				
Jalap	gr. XV	1 gm.	Produces copious watery stools and thus lessens oedema.	Blood and shreds of mucous membrane in stools, nausea, vomiting, cramplike pain in abdomen.
Compound Powder	gr. XXX	2 gm.		
Laudanum (See Opium)				
Licorice (See Glycyrrhiza)				

Drugs in Frequent Use

DRUG	AVERAGE DOSE		PRINCIPAL EFFECTS	SYMPTOMS OF OVERDOSING
	Apothecaries	Metric		
Lobelia, Tincture	m. X	0.6 c.c.	Increases bronchial secretions and relaxes the muscles of the bronchi.	Nausea and vomiting and marked collapse.
Luminal (Phenobarbital)	gr. I	0.065 gm.	Closely related to Veronal. Used to control epileptic seizures.	Circulatory depression.
Magendie's Solution (See Opium)				
Magnesium				
Carbonate	gr. XLV	3 gm.	Neutralizes acidity. Locally used as dusting powder.	Large doses of magnesium sulphate may cause failure of the respiratory center.
Citrate Solution	1 bottle	(12 ounces)	Laxative acting on entire intestinal tract.	
Oxide	gr. XXX	2 gm.	Neutralizes acidity.	
Sulphate	dr. IV Saturated	16 gm. Solution 54%	Saline cathartic acting on the entire intestinal tract. Used locally for inflammation.	
Effervescent Sulphate	dr. IV	16 gm.		
Milk of Magnesia	dr. I-IV	4.0-16.0 c.c.	Neutralizes acidity. Cathartic.	

Mercury (Hydrargyrum)				Mercury poisoning. Increased salivation, pain in abdomen, swelling and ulceration of gums, loose stools, general malaise. Preparations for local use may be absorbed and produce these toxic symptoms.
Mild Mercurous Chloride (Calomel)	gr. I–III (In divi	0.065–0.2 gm. ded doses)	Intestinal antiseptic, cathartic acting on duodenum especially, diuretic.	
Yellow Mercurous Iodide (Protiodid)	gr. ¼	0.015 gm.	Specific in syphilis.	
Red Mercuric Iodide (Biniodide)	gr. 1/20	0.003 gm.	Specific in syphilis.	
Mercury with Chalk (Gray Powder)	gr. IV	0.250 gm.	Specific in syphilis.	
Mass of Mercury (Blue Mass)	gr. IV	0.250 gm.	Effects as with calomel.	
Local preparations Mercurial Ointment Blue Ointment Ammoniated Mercury Ointment				
Methyl Morphine (See Codeine)				
Methyl Salicylate (Artificial Oil of Wintergreen)				
Morphine (See Opium)				
Morrhuae, Oleum (Cod Liver Oil) Emulsion	dr. I–IV	4–16 c.c.	Improves nutrition.	
Nitroglycerine (See Glyceryl Trinitrate)				
Nitrous Ether, Spirit of (See Ether)				
Nitrous Oxide			General anesthetic.	Cyanosis. Difficult breathing.
Novocaine (See Procaine)				

Drugs in Frequent Use

DRUG	AVERAGE DOSE		PRINCIPAL EFFECTS	SYMPTOMS OF OVERDOSING
	Apothecaries	Metric		
Nux Vomica				
Extract	gr. ¼	0.015 gm.	Stomachic and general tonic. Stimulates the reflex centers in the spinal cord, both sensory and motor. Stimulates peristalsis and gastric juices. Heart beats slower and stronger, stimulates respiration.	Strychnine poisoning. Twitching of facial muscles, shoulder, loss of control of muscular action, diarrhea, convulsions.
Tincture	m. X	0.6 c.c.		
Strychnine Nitrate	gr. 1/60	0.001 gm.		
Strychnine Sulphate	gr. 1/60	0.001 gm.		
Opium	....	....	Relieves pain, checks vomiting and peristalsis, lessens worry and restlessness, cardiac depressant, slows respiration, induces perspiration, contracts pupil of the eye. Opium has a similar action to morphine but it is absorbed more slowly and is less constipating.	*Acute*—Mental excitement followed by slow respiration, stupor, pin point pupils, weak pulse, coma from which patient cannot be aroused. *Chronic*—Constipation, loss of appetite, pupils slightly contracted, tremor, loss of weight, no will power.
Powdered Opium	gr. I	0.065 gm.		
Extract of Opium	gr. ½	0.03 gm.		
Tincture of Opium (Laudanum)	m. VIII	0.5 c.c.		
Tincture of Deodorized Opium	m. VIII	0.5 c.c.		
Camphorated Tincture of Opium (Paregoric)	dr. II	8 c.c.		
Powder of Ipecac and Opium (Dover's Powder)	gr. VII*ss*	0.5 gm.		
Morphine	gr. ⅙	0.01 gm.		

Hydrochloride........	gr. 1/6	0.01 gm.		
Sulphate............	gr. 1/6	0.01 gm.		
Magendie's Solution ..	1–30 solution of morphine sulphate			
For other alkaloids of opium see Codeine and Heroin				
Ox Gall (See Fel Bovis)				
Paraldehyde.............	m. XXX On cracked ice or in ice water	2 c.c.	Dilates the blood vessels and produces sleep.	Vomiting, stupor, cyanosis.
Paregoric (See Opium)				
Phenacetine (See Acetphenetidin)				
Phenol (See page 45)				
Phenyl Salicylate.......... (Salol)	gr. III–VIII	0.2–0.5 c.c.	Intestinal antiseptic and when absorbed acts as a salicylate.	As with phenol poisoning (See Page 48).
Phenylcinchoninic Acid (See Atophan)				

Drugs in Frequent Use

DRUG	AVERAGE DOSE		PRINCIPAL EFFECTS	SYMPTOMS OF OVERDOSING
	Apothecaries	Metric		
Phosphorus	gr. $\frac{1}{25}$	0.5 mg.	Furthers the deposit of calcium in growing or repairing bone.	Abdominal pain, nausea, vomiting, diarrhea; stools, vomitus and urine have garlic odor and in dark are phosphorescent. Jaundice. Chronic poisoning results in necrosis of the jaw bone.
Phosphorated Oil	m. I–V	0.065–0.3 c.c.		
Physostigmine (Eserine)			Stimulates peristalsis, secretions of saliva, mucus, sweat, gastric and pancreatic juices. Applied locally to the eye it contracts the pupil and diminishes the tension in glaucoma.	Abdominal pain, nausea, vomiting, diarrhea, excessive secretions, slow, weak pulse, difficult breathing, contracted pupils, twitching of muscles.
Salicylate	gr. $\frac{1}{60}$	1 mg.		
Sulphate	gr. $\frac{1}{60}$	1 mg.		
	Local solution 0.1–1 %			
Pilocarpine (Jaborandi)				
Hydrochloride	gr. $\frac{1}{60}$–$\frac{1}{6}$	0.001–0.01 gm.	Produces excessive secretions of sweat and salivary glands. Increases contractions of involuntary muscles in stomach, intestines and bronchi.	Profuse saliva, tears, diarrhea, vomiting, slow, weak pulse, difficult breathing, due to contracted bronchi.
Nitrate	gr. $\frac{1}{5}$	0.01 gm.		

Pituitrin (Hypophysis)	m. XV	1 c.c. Hypodermic	Contracts the blood vessels and raises blood pressure in shock. Used in obstetrics to check bleeding from uterus and stimulate uterine contractions after labor.	
Potassium				
Acetate	gr. XXX	2 gm.	These salts are marked diuretics and render the urine alkaline.	
Bicarbonate	gr. XXX	2 gm.		
Bitartrate	gr. XXX	2 gm.		
Citrate	gr. XV	1 gm.		
Citrate, Effervescing	dr. I	4 gm.		
Chlorate	....	....	Used locally as a mouth wash and gargle.	
Iodide (See Iodides)				
Bromide (See Bromides)				
Permanganate (See Page 58)				
Potassium and Sodium Tartrate (Rochelle Salt)	dr. II	8 gm.	Saline cathartic.	
Powder, Compound Effervescing (Seidlitz Powder)	2 papers, white and blue		Saline cathartic.	
	White—Contains Tartaric Acid			
	gr. XXXV	2.25 gm.		
	Blue — Contains Sodium Bicarb.			
	gr. XL	2.5 gm.		
	Potassium and Sodium Tartrate			
	dr. II	8.0 gm.		
Procaine (Novocaine)	Used in 3% solutions		See Cocaine.	See Cocaine.
Pyramidon	gr. IV	0.25 gm.	See Antipyrine.	See Antipyrine.

Drugs in Frequent Use

Drug	Average Dose		Principal Efects	Symptoms of Overdosing
	Apothecaries	Metric		
Quinidine Sulphate	gr. III	0.2 gm.	Heart stimulant. Restores the normal rhythm of the heart in auricullar fibrillation.	Nausea and vomiting, headache, palpitation of the heart.
Quinine	gr. IV	0.25 gm.	Improves digestion and nutrition. Its chief use is as a specific in malaria. It is also used as an antipyretic and to stimulate uterine contractions.	Ringing in the ears, nausea and vomiting, slow, weak pulse, muscular weakness, hemianopia (blindness in one-half the field of vision in one or both eyes).
Bisulphate	gr. IV	0.25 gm.		
Hydrochloride	gr. IV	0.25 gm.		
Sulphate	gr. IV	0.25 gm.		
Tannate	gr. VII*ss.*	0.5 gm.		
Quinine and Urea Hydrochloride	gr. IV For subcutaneous injection for anesthesia a solution of from 0.25 to 1%. Applied to mucous membranes 10-20%.	0.25 gm.	Has the action of quinine but may be used hypodermically without irritation of tissues. Has also an anesthetic action when injected or applied to mucous membranes.	
Rhamnus Purshiana (Cascara Sagrada)	....	....	Cathartic which acts mainly on the colon.	
Fluidextract	m. XV	1 c.c.		
Aromatic Fluidextract	m. X–XXX	0.6–2 c.c.		
Extract	gr. II–VIII	0.125–0.5 gm.		
Rhubarb (Rheum)	gr. XV	1 gm.	Stomachic and cathartic. Acts especially on the colon.	
Extract	gr. IV	0.25 gm.		
Aromatic Tincture	m. XXX	2 c.c.		
Aromatic Syrup	dr. II	8 c.c.		

Ricini Oleum (Castor Oil) . .	dr. IV	16 c.c.	Cathartic acting on both the small and large intestine.	
Rochelle Salts (See Potassium)				
Salicylic Acid	. . . .	. . . .	Specific in rheumatism. Relieves pain in acute joint conditions; relieves neuralgic pains.	Ringing in ears; nausea and vomiting, slowing of respiration, increased amount of urine; collapse.
Acetylsalicylic Acid (Aspirin)				
Sodium Salicylate	gr. XV	1 gm.		
Salol (See Phenyl Salicylate)				
Salvarsan . . . . (Arsenobenzol) (Arsphenamine) (Arsphenolamine hydrochloride) ("606") (Neosalvarsan)	gr. VIIss. Given in	0.5 gm. travenously	A preparation of arsenic which is a specific remedy for syphilis in all stages. It is also used in relapsing fever, Vincent's Angina and other diseases due to a spirillum.	There may be an anaphylactic reaction (serum sickness) after its administration — headache, nausea, vomiting, chills, rise in temperature, rash.
Santal Oil	m. VIII	0.5 c.c.	Antiseptic for genito-urinary tract and the bronchial mucous membrane.	
Santonin	gr. I	0.065 gm.	Has a poisonous action on intestinal parasites and is used in the treatment of round worms.	Yellow vision, convulsions.
Scopolamine (See Hyoscine)				
Seidlitz Powder (See Powder)				

Drugs in Frequent Use

DRUG	AVERAGE DOSE		PRINCIPAL EFFECTS	SYMPTOMS OF OVERDOSING
	Apothecaries	Metric		
Senna	gr. LX	4 gm.	A purgative acting on the colon.	
Fluidextract	m. XXX	2 c.c.		
Syrup	dr. I	4 c.c.		
Sinapis (Mustard)				
Black	dr. II	8 gm.	Emetic and counter-irritant.	
Sodium				
Arsanilate (See Arsenic)				
Arsenate (See Arsenic)				
Benzoate	gr. XV	1 gm.	Has action similar to sodium salicylate.	
Bicarbonate	gr. XV	1 gm.	Neutralizes acidity. (See P. 70.)	
Bromide (See Bromides)				
Cacodylate	gr. ½	0.03 gm.	See Arsenic	See Arsenic
Chloride	dr. IV As an	16 gm. emetic.	(See page 62.)	

Sodium (*Continued*)				
Iodide				
(See Iodides)				
Nitrite	gr. I	0.065 gm.	See Amyl nitrite.	
Phosphate	m. XXX	2 gm.	Saline cathartic.	
Acid Phosphate	gr. XV–XXX	1–2 gm.	Renders the urine acid.	
Effervescent Phosphate	dr. II	8 gm.	Saline cathartic.	
Salicylate				
(See Salicylic Acid)				
Sulphate (Glauber's Salt)	dr. IV	16 gm.	Saline cathartic.	
Sparteine Sulphate	gr. 1/6	0.01 gm.	Slows and weakens the heart.	Staggering gait, weakness of limbs, inability to swallow.
Squill	gr. II	0.125 gm.	Nauseating expectorant. Has similar action to digitalis on the the heart. Also acts as a diuretic.	
Tincture				
Syrup	m. XXX	2 c.c.		
Strophanthus, Tincture	m. VIII	0.5 c.c.	Has an action similar to digitalis but it is much more poisonous and the effects are seen more quickly.	As with digitalis.
Strophantin	gr. 1/200	0.0003 gm.		
Strychnine				
(See Nux Vomica)				
Sulphonal	gr. XV	1 gm.	Hypnotic and sedative. Requires five or six hours for its action.	See Sulphonethylmethane
(Sulphonmethane)	In hot milk			

Drugs in Frequent Use

DRUG	AVERAGE DOSE		PRINCIPAL EFFECTS	SYMPTOMS OF OVERDOSING
	Apothecaries	Metric		
Sulphonethylmethane (Trional)	gr. XV	1 gm.	Hypnotic and sedative. Requires about an hour to secure action.	Pinkish tinged urine, lassitude, nausea and gastro-intestinal disturbance, paresis of various muscles, loss of reflexes, collapse.
Supracapsulin and Suprarenalin (See Epinephrine)				
Sweet Spirit of Nitre (See Ether)				
Terebinthina (Turpentine) Oil	m. XV	1 c.c.	Relieves flatulence.	
Terpin Hydrate..........	gr. II	0.125 gm.	Expectorant, diaphoretic and diuretic.	
Theobromin ... . Sodium Salicylate (Diuretin)	gr. V gr. VIIss.	0.3 gm. 0.5 gm.	Diuretic and thereby relieves oedema.	
Thymol....	gr. II	0.125 gm.	Destroys hookworms.	Ringing in the ears, nausea, vomiting, collapse.

Thyroid	gr. I	0.065 gm.	Stimulates metabolism. Loss of weight. Used in cretinism and myxedema to supply thyroid secretion which is deficient.	Rapid pulse, nervousness, tremors, headache, flushing of face, perspiration.
Tiglii, Oleum (Croton Oil)	m. I (In butter, olive oil or on sugar)	0.065 c.c.	Drastic cathartic.	
Trional (See Sulphonethylmethane)				
Turpentine (See Terebinthina)				
Urotropine (See Hexamethylenamine)				
Valerian				
Ammoniated Tincture	m. XXX	2 c.c.	Antispasmodic and nerve sedative.	
Tincture	dr. I	4 c.c.		
Vallet's Mass (See Iron)				
Veratrum, Tincture of	m. XV	1 c.c.	Heart depressant. Reduces blood pressure.	
Veronal (Barbital)	gr. V In hot milk	0.3 gm.	Hypnotic. Action begins in about half an hour.	Slow pulse, shallow breathing.
Veronal Sodium (Medinal)	gr. V	0.3 gm.	Acts more rapidly than veronal.	
Viburnum Fluid Extract	m. XXX	2 c.c.	Uterine sedative.	
Zingiber (See Ginger)				

COMMON PREPARATIONS USED EXTERNALLY

Alboline—refined liquid petroleum. Used for protection and softening of skin.

Ammoniated Mercury Ointment. Used in skin inflammations as an antiseptic and local stimulant.

Aristol (Thymol Iodide). Used as an antiseptic dusting powder.

Arnica, Tincture of. Used on bruises or as a counter-irritant.

Balsam of Peru. Used to stimulate granulation of tissues.

Black wash. Calomel and lime water. For syphilitic ulcers and lesions as well as in other skin affections.

Blue Ointment. Dilute mercurial ointment. Used as an antiparasitic.

Boric Acid Ointment. Used in exzema and other skin diseases and as a soothing and protective ointment for burns.

Calamine Lotion. Zinc oxide, zinc carbonate (calamine) glycerine, lime water and rose water. Used as antipruritic.

Camphorated Oil—20 grams of camphor in 100 c.c. of cotton seed oil. Used as a counterirritant.

Carron Oil. Equal parts of lime water and linseed oil. Used for burns.

Chloroform Liniment. 30% chloroform—70% Soap liniment. Used as a counterirritant.

Lassar's Paste. Salicylic acid, zinc oxide, starch and petrolatum. Used in ring worm, exzema, excoriations of the skin.

Lead and opium lotion. Lead acetate and laudanum. Used in ivy poisoning.

Magnesium sulphate—Saturated solution 54%. Used to allay itching and inflammation.

Mercurial Ointment (Unguentum Hydrargyri) — contains 50% of mercury. Used in the treatment of syphilis.

Mustard plaster—1 part of mustard to 3 parts of flour for an adult. 1 part of mustard to 8 parts of flour for child. Mix with tepid water.

Oil of Wintergreen (Methyl Salicylate, Oil of Gaultheria). Used as a liniment. Counterirritant.

Tar Ointment. Used in the treatment of exzema. Liquid petrolatum will remove it from the skin.

Tyson's Paste. Flour, mustard, 3 tablespoons of each—white of 1 egg.

Glycerine 4 drams. Used as a mustard plaster but may be left on the skin for a longer period.

Yellow mercuric oxide ointment. Used in the treatment of granular lids, conjunctivitis, exzema.

Yellow wash. Bichloride of mercury in lime water. Syphilitic ulcers, etc.

Zinc oxide ointment. Used for excoriations of skin and as a protective ointment.

PRACTICAL POINTS IN THEIR USE

Dusting powders—

1. Prevent friction and chaffing.
2. They should be free from grit.
3. Never use where there is a purulent discharge.

Ointments—

1. Ointments should not be used if they have a rancid odor.
2. Preserve the cleanliness of the ointment by using a clean tongue blade to remove the ointment. If the ointment is sterile remove it with a sterile tongue blade.
3. If the surface is inflamed and oozing, apply thickly on gauze and place it on as a plaster.
4. If the condition is dry rub it in well.
5. All ointments used for systemic effect must be well rubbed in.

Wet dressings—

Two types: Open—Where evaporation is desired.
Closed—For indolent lesions. They must be covered with oiled silk.

1. Never keep the solution from one dressing to another.
2. Never use cotton except between layers of gauze.
3. After wet dressings have been used over a period of time when they are discontinued the skin should be protected with an ointment such as boric ointment or vaseline.

LEGAL STANDARDS

The United States Pharmocopeia contains the pharmaceutical preparations whose methods of preparation, ingredients, strength, etc. conform to the standard set by a committee of physicians and pharmacists. This book is revised every ten years and the preparations contained therein are known as "official preparations." Sometimes the letters U.S.P. are used after them. The National Formulary is also published every ten years by the American Pharmaceutical Association. It contains the formulae for many preparations frequently prescribed by physicians but which are not included in the Pharmacopeia. These books give the legal standards for pharmaceutical preparations.

The Pure Food and Drugs Act requires that drugs sold under the name given in the United States Pharmacopeia and National Formulary must meet these legal standards. The labels must also state the presence and quantities of such drugs as alcohol, opium, cocain and its derivatives, chloroform, chloral hydrate, acetanilid. The various state laws require that certain drugs shall be labeled poison and a record kept of the sale. The laws differ in various states but the list usually includes such drugs as preparations of mercury, strychnine, arsenic, phenol and the cyanides.

The American Medical Association has a council on Pharmacy and Chemistry which investigates and analyses new drugs which are placed on the market. Those which they consider valuable they include in "New and Non-Official Remedies," a book which is published annually.

The Harrison Law which has been in effect since March 1915 refers to the importation, manufacture, handling and sale of narcotic drugs. Wholesale and retail druggists who sell these drugs and all physicians and dentists who prescribe them must be registered with the Department of Internal Revenue. A nurse may only have these narcotic drugs in her possession as the agent to the physician, when caring for a patient. A record must be kept of the sale of these drugs and hospitals are obliged to keep a record of these drugs and the amounts which are dispensed to the different wards. In writing a prescription for these drugs the physician must give the name and address of the person for whom prescribed, it must be signed by him, dated on the day signed and give his registry number. The pharmacist may not refill the prescription. The drugs included under this act are all preparations of opium and coca and their derivatives, except such preparations as contain less than two grains of opium or grain ¼ of morphine or grain 1 of codein or grain ⅛ of heroin in an ounce. Liniments and ointments are exempt except those which contain preparations of cocain or eucain.

SUGGESTIONS FOR INSTRUCTOR

Drill. Have students measure in both systems and work out the equivalents. Demonstrate the difference between drops and minims and the variability in the size of the drop with alcohol, oils, glycerine, water. Demonstrate a solution with a few grains of copper sulphate in a test tube of water, a suspension with a few grains of chalk in a test tube of water. Dissolve 0.5 gm. boric acid crystals in 10 c.c. of water in a test tube. To another 10 c.c. of water add 1 gm., heat, and then allow it to cool to show the effect of temperature on solubility.

In working out the problems give both oral and written problems. If blackboard space is available have the students work on the blackboard so that the arithmetic may be checked. Solutions should be made in the laboratory.

In the classes on the various disinfectants the following demonstrations may be given.

Phenol. Put a few drops of Phenol in a test tube of cold water and a few drops into a test tube of boiling water to show the necessity of using hot water in making solutions of Phenol.

Bichloride. Demonstrate the effect of egg albumen on bichloride solution.

Potassium permanganate. Demonstrate the decomposition of potassium permanganate by alkalies or acids by putting a few drops of each in test tubes of potassium permanganate. Demonstrate the effect of oxalic acid on potassium permanganate and its application in the removal of stains.

Silver nitrate. Demonstrate the chemical reaction between saline solution and solutions of silver nitrate, making the application to the prophylactic treatment of the eyes of the new born. Put a few drops of silver nitrate solution in a test tube of tap water to show its reaction with salts and therefore the necessity for using distilled water in preparing solutions of silver nitrate.

Sodium bicarbonate. Dissolve some sodium bicarbonate in a glass of water and then test the water with red litmus paper, or phenolphthalein solution.

Normal salt solution. Stain a small piece of onion epidermis with eosin and have the students examine it under the microscope. Wash off the eosin and flood the epidermis with 10% salt solution allowing it to remain 3 minutes before examining it under the microscope. This will illustrate plasmolysis. Demonstrate the proper method of folding filter paper and filtering through cotton.

Hydrogen peroxide. Put a few grains of manganese dioxide in 10 c.c. of hydrogen peroxide and test the gas evolved with a lighted splinter. The manganese dioxide acts as a catalytic agent. The blood probably contains an enzyme (organic catalytic agent) which frees oxygen from hydrogen peroxide.

Iodine. Put a few crystals of iodine in a test tube of water and a few in alcohol.

Boric acid. Demonstrate the weak acid properties of boric acid solution by testing it with blue litmus paper.

Pharmaceutical preparations. Show the various preparations and use the Pharmacopoeia for illustrations of how they are prepared.

Reference Books for Drugs and Solutions.
BLUMGARTEN—Materia Medica for Nurses.
BASTEDO—Materia Medica and Therapeutics.
SOLLMANN—Text Book of Pharmacology.
SMITH—Elementary Chemistry.
BROADHURST—Home and Community Hygiene.
ROSENAU—Preventive Medicine.

Text Book for Materia Medica.
BLUMGARTEN—Materia Medica for Nurses.
Reference Books for Materia Medica.
BASTEDO—Materia Medica and Therapeutics.
SOLLMANN—Text Book of Pharmacology.

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